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Government Control

Possible Delegation of Powers

CONSIDERABLE discussion is taking place upon the subject of Government control, a matter which concerns the electrical industry as closely as any. All parties agree that during the war everything must be directed towards securing victory, which means that the State must direct the lives and properties of all its citizens. It is also generally agreed that there cannot be a sudden withdrawal of control when the war ends; but differences arise over the extent and duration of such control as may be retained.

One aspect of the question should be seriously considered. Control is at present largely designed and exercised by men who have considerable knowledge of the commodities or industries with which they are dealing. Such men could be found only in the service of industrial concerns and they have accordingly been "seconded" for wartime service with the Government Departments.

Knowledge and Understanding

After the war, unless they are forcibly retained, these men will return to their normal occupations. When they depart from Whitehall and its many branches the business of control will be left in the hands of civil servants, many of whom, though quite able administrators, do not possess the intimate knowledge and understanding necessary for the work. During the war those in industry have felt that the presence in the various controls of men who know has been a safeguard against control for control's sake. When these men depart from the Government service a healthy steadying influence will be lost.

It is not sufficient that there should be one or two "experts" in each department; the detailed operation of control requires practical knowledge if it is to run smoothly. If continued control is necessary it may be found that these details are better left to trade organisations which are already equipped to deal with such matters, provided, of course, that those organisations are willing to undertake the rather onerous task.

Protecting Public Interest

The Governmental part would be, first, to formulate broad policies, which the associations or federations would be required to work out in the best possible way, and, secondly, to ensure that the best interests of the public were being served. This general supervision might be exercised through representatives upon the Councils of the Associations.

On the face of things there are obvious objections to such a system. It may be contended that non-federated firms would not be fairly treated and that the "small man" particularly would be adversely affected. But it should not be impossible to devise schemes which would operate fairly as between members and non-members. A precedent, limited it is true, has been established during the war in the shape of the allocation of material for export orders by trade associations.

We do not desire to see a corporative system built up in this country. What

should be aimed at is a delegation by the State of *necessary* control (or perhaps "regulation" is a better word) to those with sufficient experience to handle it in a manner least irksome to industry and to the community.

Reorganisation

So far we have refrained from commenting on the I.M.E.A. proposals for dealing with the ownership of distribution systems and generating stations for the reason that the memorandum containing them is not necessarily the last word on the subject. It has yet to be approved by the members of the Association and a meeting for this purpose is to be held on March 16th. While the members of such an Association must necessarily approve the retention and possible extension of municipal ownership as a general principle, the smaller undertakings will no doubt strive to preserve their separate identities. This is evident from the letters which we have recently published from Mr. A. J. C. DeRenzi, the principal spokesman of these authorities.

Generation

LITTLE opposition will be forthcoming from the smaller undertakings to the proposal that generation should be placed under central control in an endeavour to secure uniformity in bulk supply charges. The owners of selected stations will view the proposal from a very different angle. Members of the I.M.E.A. in this position were to meet on Wednesday last but the results of their discussion of the subject were not available at the time of going to press. It may, however, be anticipated that the memorandum will not be accepted by either of the two classes of authority which we have mentioned without attempts to secure amendments or the insertion of provisos or "safeguards."

Profits and Rates

DURING its successful career the Liverpool Electric Supply Department has contributed sums approaching the £2,000,000 mark towards the relief of the city's rates. This year, although the surplus is likely to be of the same order as last year, the Electric Power and Lighting Committee has decided not to hand over any of it to the rate fund. (Last year a sum of £15,000 was contributed and in the preceding year £40,000.) Instead, the whole of the surplus will be placed to reserve, raising it to £850,000 which is said to be about £133,000 in excess of the statutory requirement. It is in the best interests of consumers that this method should be adopted in preparation for the post-war expansion.

Rehabilitation

PUBLICATION of a memorandum by the Ministry of Health on the organisation of a hospital rehabilitation department has led the Electrical Industries Benevolent Association to draw attention to the fact that this form of social work has occupied its attention for many years. It discovered long ago that financial assistance alone was insufficient to put a man on his feet. The circumstances of each case must be thoroughly and sympathetically studied so that in addition to getting monetary relief the recipient is encouraged to believe in himself and in his ability to recover his place in the community.

Coal Shortage

A FURTHER warning to industry has been issued by the Ministry of Fuel and Power. There has already been a cut of 10 per cent. in coal supplies and the Ministry says that there can be no guarantee that even the reduced allocation will be delivered regularly, and there will be increasing transport difficulties with the growing military activity. Consequently manufacturers are exhorted to take the most drastic steps to cut down the consumption of coal, oil, gas and electricity in their works. Coupled with this is an appeal to industrial consumers to clear wagons as rapidly as possible to avoid congestion and delay.

American Coal Situation

MANY difficulties encountered here have their counterpart in the United States; coal troubles, for instance, are common to both countries. During October last the consumption of bituminous coal by American electrical utilities rose by 5·1 per cent. as compared with September, but the average day's supply fell by 7·4 per cent., reducing the stock piles from 81 to 74 days' supply; this was considerably better, however, than the national "stock pile" figure of 42 days' supply. The 1944 production aim is 620 million tons but this, it is pointed out, will probably

have to be revised upward. Mr. Harold L. Ickes, the Solid Fuels Administrator, is of the opinion that even with the present manpower it seemed impossible to produce more than 604 million tons.

Internal-Combustion Engines

A MEMBER of the B.B.C. "Brains Trust" recently implied that the inventor of the internal combustion engine had conferred rather less than a boon on humanity. If this were so (which we do not believe) on whom should the condemnation fall? Between Street, who, 150 years ago, proposed mixing turpentine vapour with air as a means of propelling a piston, and Diesel, a century later, there were many who contributed to the final result. These include such men as Beau de Rochas, Otto, Dugald Clerk, Priestman and Akroyd-Stuart, but in addition there have been numerous engineers, hardly known by name, whose work was necessary to enable high-powered engines to be produced of a unit size and weight that has made possible modern efficiency and performance.

Gas Turbines

As happened earlier with steam, a change from reciprocating to rotary motion represented a new stage. The overall efficiency of the gas turbine for driving mechanism is limited by the large proportion of the power produced that is required to drive the compressor and by the temperatures safely attainable. In the new application of the jet-propulsion principle to aeroplane propulsion all the output is absorbed by the compressor and the energy assumes a different form. It does not detract from the primary credit due to Group Capt. Whittle to agree with his broadcast statement that the results achieved can be attributed to the co-operation of many people. These include, as we show elsewhere in this issue, the engineers of a leading British electrical manufacturing concern with the backing of its resources.

Electrical Apprenticeship

THE Council of the Association of Supervising Electrical Engineers has always evinced a lively interest in the maintenance of high standards in the electrical industry, and has now issued new proposals for putting electrical apprenticeship (installation and maintenance) on a proper basis. Its first essay in this direction appeared in 1928 when it was suggested that a Central Apprenticeship Board should be set up and that indentures should be between the Board and the apprentices' parents. To meet objections to this form of independent control, the Association has conceded, against its better judgment apparently, that the parties to indentures shall be the parents and the employers. The vast amount of electrical work in prospect necessitates such a plan as this to ensure a supply of competent well-trained electricians. We are not forgetting that the E.C.A. does a great deal to encourage its members to train apprentices, but maybe they would find advantages in a central scheme which would relieve them of some of their responsibilities.

Fair Trading

WAR conditions have naturally restricted the operations of the Electrical Fair Trading Council whose report for 1943 is published in this issue. The Council's principal aim is the prevention of undercutting of prices by the granting of excessive discounts, or the allowing of discounts to those not entitled to them. Nowadays equipment and appliances are so hard to come by that purchasers will give almost any price for them, which is about as pernicious as the practice of undercutting. But it is the business of the Board of Trade to prevent this, however unsuccessful it may be. There is no doubt that after the war all kinds of people will try to "crash into" the electrical industry and the Council will have its hands full in endeavouring to keep the business clean. We are particularly glad to see a reference in its report to the combating of the menace of unsafe appliances.

Another Association

PARTICULARS have been sent us of a new "Society of Electric Accumulator Manufacturers" one of whose objects is to "form a channel through which the industry can be consulted by Government Departments and others"—a function which we should have imagined was already adequately performed by the Accumulator Manufacturers' Association. Another object is the maintenance of fair trading conditions; the A.M.A. is already represented on the Fair Trading Council.

Electron Microscope

Part II : Specimen Mounting and Typical Results

By W. Wilson,
D.Sc., B.Eng., M.I.E.E.

IT would probably be true to say that every branch of science has benefited, or will benefit, from the work of the electron microscope, as described last week, for practically all are handicapped by lack of knowledge as to happenings among components that are too small to be viewed by other means.

The very great majority of microscope specimens must be mounted upon a transparent support. Glass of any convenient thickness is the most suitable material when the illuminant is visible light, but in common with all substances, whether solids, liquids, or gases, it is opaque to an electron stream if its thickness much exceeds 10^{-6} cm. (0·01 μ). A new technique has therefore been built up, notably by Dr. L. Marton, whereby specimens may be adequately prepared for examination.

Fig. 1.—Lead arsenate insecticide particles ×56,500

Specimens are usually mounted at the lower end of a small cartridge-shaped tube, somewhat under an inch in length, with a bore of about 0·02 in. diameter. A membrane of the required thickness (0·01 μ) is first formed by allowing a small drop of collodion, or celluloid "cement," to fall on to the surface of water and spread out. This quickly sets and is then brought into contact with its immediate support, a small circular disc of 200-mesh wire gauze, less than $\frac{1}{4}$ in. in diameter, by carefully placing the latter upon the solidified cellulose. Gentle pressure upon the gauze causes it to adhere to the film.

By means of delicate handling tools, the coated discs are separated from the rest of the membrane, lifted from the water, inverted so as to bring the film side uppermost, and placed upon a miniature pedestal. There the water clinging to the surface is removed, and a drop of a liquid containing the specimen in suspension, or solution, is placed upon it and the liquid allowed to evaporate. The whole is then placed in position on the cartridge, which in its turn is inserted through the air-lock into the interior of the microscope tube, *i.e.*, into the space about to be evacuated.

The presence of the cellulose support can be seen (Fig. 1) where the expansion of the aggregate has caused the membrane to fold at the bottom. Three layers thus have to be penetrated instead of one, and the resulting shadow indicates that even this minute thickness of ordinarily transparent material is far from being perfectly transparent to cathode rays. Some idea of the enormous magnification may be obtained when it is realised that the accompanying records are only a small portion of what is seen through one mesh of the finest gauze used in industry.

Typical Micrographs

The work of the electron microscope will be exemplified by means of typical records made by the large R.C.A. instrument already described.

Dusts and smokes are among the simplest kind of materials to view in the electron microscope, revealing groups of ultra-microscopic particles that float in the air. Much research has been carried out into this subject since the present instruments became available, largely in connection with diseases of the respiratory organs. As the greater part of the particles found in the human lungs are less than 5 μ in diameter, and an appreciable portion less than 0·2 μ, there is a great deal of information to be obtained that has hitherto been beyond normal vision.

The example (Fig. 2) of a mass of smoke particles resulting from the combustion of magnesium ribbon, magnified 70,000 times, shows that most of the small grains are obviously crystals having the form of cubes. Burning zinc produces equally minute dendritic crystals each consisting of four spicules less than 0·04 μ thick, meeting at a point; while aluminium oxide smoke is made up of strings of spherical globules.

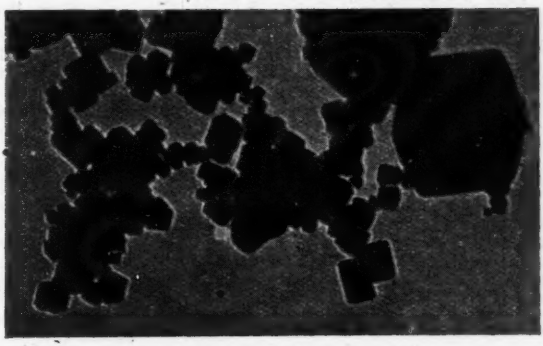


Fig. 2.—Magnesium oxide smoke ×70,000

Powders are required for many useful purposes which must possess as extensive a surface as possible, involving extremely fine subdivision and a favourable particle-shape. It frequently happens that certain samples are found to produce much more efficient results than others, and in such cases it is obviously important to know the reason for their superiority. In one instance a certain kind of face-powder was much in demand because of the effective way in which it clung to the skin. A high-power micrograph showed that its particles were of a highly angular shape, capable of hooking themselves into the tissue. Another example is (Fig. 1) a sample of lead arsenate insecticide which possessed unusual covering power and deadliness. The micrograph (×56,500) indicates the reason, namely, that the particles consist of extremely thin flakes, which naturally possess a large surface and clinging ability, and are more readily eaten by the insects. Particles of zinc-white pigment can also vary, those formed in the one way being angular and spherical in the other, so causing one to be superior to the other for painting purposes.

An example from organic chemistry that illustrates several of the categories of knowledge now being revealed in that field (Fig. 3) is vinyl chloride in which the process of polymerisation is incomplete. The micrograph, a magnification of ×55,000, indicates the composition of a rubber-like material, and also reveals the change effected by polymerisation.

A further micrograph was recently published (*Trans. A.I.E.E.*, April, 1940, Vol. 60, p. 161) in which case the polymerisation is complete, forming p.v.c. (polyvinyl-chloride). The magnification of ×100,000 shows the surface of the material to be mottled with an evenly-spaced succession of spots. As their size corresponds with that of the unusually large molecules of the material, there is little doubt that visual confirmation is here obtained of the truth of the molecular theory.

Of all branches of science, that which appertains to the health and welfare of the human body, and of the animals and plants upon which mankind depends for his sustenance, has the most universal appeal. But the fight against disease has been greatly handicapped by the inability to see many of the malignant agents that are its cause. Most mysterious of all were the filter-passing viruses, the existence of which was originally only conjectured. Now they can be seen, and their characteristics investigated. These substances are of special interest in that they almost certainly form the connecting link between the living and non-living states. They appear to be crystalline substances, those so far isolated being nucleoproteins, and yet they have the faculty of self-reproduction. Closer study now possible with the microscope should therefore yield very important results.

Other viruses which have been isolated and photographed are those responsible for the diseases of the cucumber, tomato and tobacco plants, and all resemble one another in that no trace of body structure can be detected.

Bacteria, however, have been revealed as having a complicated structure, including flagella in some cases and in others a hard outer shell, from which the interior has been

seen to emerge as it perishes. But the last example is in the opinion of the author one of the most dramatic and sensational ever produced. Medical men have deduced the existence of "anti-bodies" in the blood, or system, whose function is to prey upon the harmful bacteria and put an end to their existence. Like viruses, they will pass through any filter, but it has been thought that an occasional vague indication of one has been caught by the highest-power light microscope. The theory is that the organism reproduces itself by fission, so that just before splitting up it is twice normal size and then just comes within range. The last micrograph (×67,000) shows one end of a bacillus that inhabits the human intestines, *Escherichia coli*, actually being attacked by these bacteriophages (Fig. 4). Their method of propulsion, by means of long tail-like flagella, is clearly shown and their size is exactly indicated.

Characteristics of Electron Micrographs

The chief advantage which the electron micrograph possesses is its greatly increased scale, about which sufficient has been said. But another characteristic, which is usually an advantage, is the great depth of focus. This is an inherent property and may be observed, notably in Fig. 3, where every part of the object is in sharp focus, whereas a light microscope would render sharp only those parts at a given level, all others being out of focus. There are occasions, however, when the latter instrument is required, in order to be able to isolate one element from the others, and by selective focusing to obtain a measure of the distance between successive strata or layers in the "up-and-down" direction.

Some Problems and Limitations

It must be remembered that high power brings its own difficulties with it. "Finding" a given part of the object is of increased difficulty, and the M.V. instrument incorporated an ingenious arrangement whereby a ×100 light microscope was built into the electron magnifier and carried out the preliminary search. The method already described of locating the "first" image before proceeding to the second has, however, proved in practice to be more convenient, and much the simpler solution to the problem.

Further, the bombardment of the object with high-speed electrons produces heat which is capable of damaging delicate substances. Certain types of specimens cannot therefore be viewed in this way, while others require care as regards intensity of beam or length of exposure, and possibly special preparation.

An additional restriction encountered is that the object is situated in a high vacuum and must therefore be dry. Great difficulty is experienced in viewing anything but "dead" specimens, and in consequence movement, such as that which would have been so entertaining in Fig. 4, must almost inevitably be "frozen," and require a

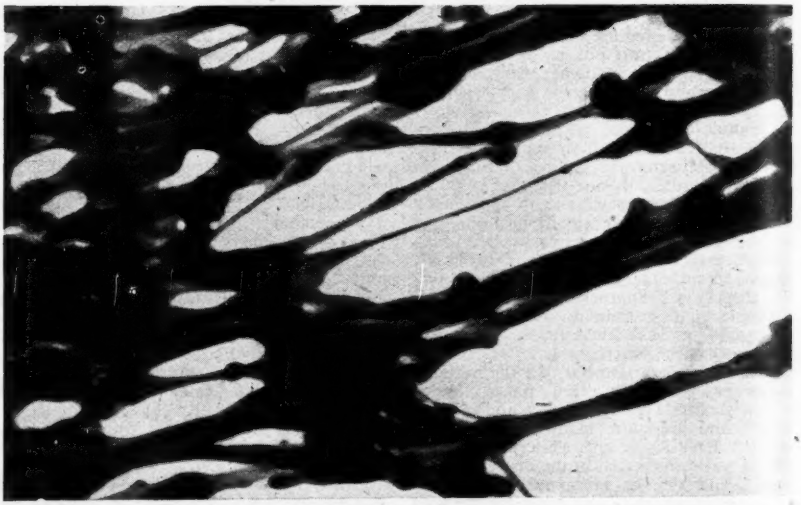


Fig. 3.—Vinylite, partly polymerised vinyl chloride, as used in manufacture of hemp rope ×55,000

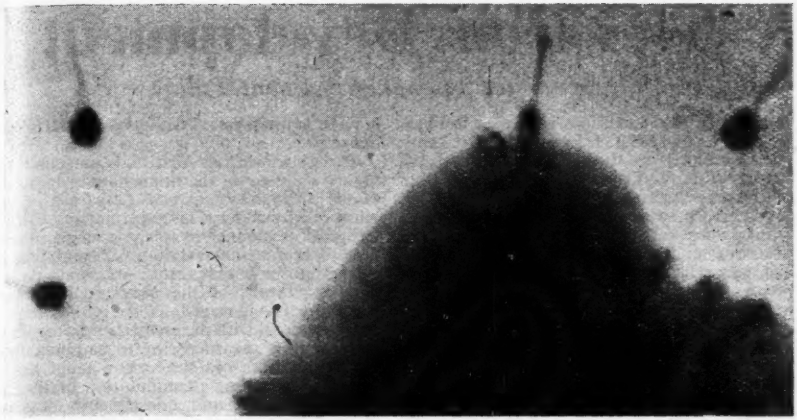


Fig. 4.—Part of *Escherichia coli* from human intestine being attacked by bacteriophages ×67,000

number of successive and similar operations to show progressive action.

Another limitation is the impossibility of using the surface of a thick material as an object, as can be done with the optical microscope by means of reflected light in metallography. However, the difficulty has been largely overcome by taking a "cast" of the desired surface in celluloid, or other suitable plastic, the thickness of the coating being of the order of 10^{-6} cm. The plastic film is then detached or isolated and itself treated as the object. In this way most successful investigations have been made in connection with the structure of metals and alloys. For example, certain important gaps in our knowledge of the nature of steels have been filled up.

The excellent results obtainable by the replica method emphasise a further distinction between light and electron micrographs, namely, that with the former the differences in density are frequently due to differences in the refractive index of the object; while with electron records they are derived solely from changes in the thickness.

Conclusion

In spite of the limitations that have been indicated to the application of the electron microscope, it has been shown to be an instrument that has unlocked a vast store of knowledge of really vital importance to nearly every department of pure and applied science. Fresh discoveries are being made daily by its instrumentality, and there is so much scope for continued improvement in its design and capabilities that there is every prospect of a continuance of its revelations for a long time to come. Its use by British investigators, whether in research or industrial laboratories, is not only very desirable, but even imperative if our manufacturers are to compete on favourable terms with those of other nations.

The author acknowledges the assistance of the R.C.A. Manufacturing Co. in illustrating this article.

X-Ray Shielding

FOR a new research laboratory in the United States, it is stated in the *Engineering News-Record*, earth-filled concrete-block walls, instead of thick layers of lead, have been used to shield operators of X-ray equipment. The floors and roof of the one-storey building are plain concrete slabs; the walls, other than the earth-filled ones, are simple concrete blocks. The structure houses two experimental rooms, an operator's room, a waiting room and two small offices. The smaller of the two experimental rooms will house high-frequency X-ray equipment operating at 20 million volts and the larger room an electrostatic generator operating at 3 million volts.

The walls, which surround the two rooms housing the X-ray equipment and their entrances, have a minimum thickness of 5 ft.; their inner and outer faces are of concrete block 1 ft. thick and between them is 3 ft. of earth added after construction. The walls separating the operators' room from the equipment are 10 ft. thick. The walls are tied together by 8- by 8-in. reinforced-concrete ties spaced at 4 ft., and cells in the concrete block are filled solidly with mortar. Other than the 12-in. long rods at the top and bottom of the walls tying them to the roof slab and footings and four ⅜-in. round rods in each concrete tie, no reinforcing steel is used.

Observation windows in the 10-ft. thick walls consist in each case of a 4-in. diameter pipe closed at both ends with a ½-in. thick plate-glass plug and filled with clear water. Openings through the walls for water pipes and electrical conduits have elbow turns that eliminate direct openings from the experimental rooms.

Television Development

Dependence upon Government Policy

POST-WAR television is surveyed in a paper by MR. B. J. EDWARDS (Pye, Ltd.) presented to the Wireless Section of the Institution of Electrical Engineers with the object of directing attention to some of the problems that will have to be faced.

It was cost rather than technical considerations that tended to retard pre-war expansion. The same factors are likely to be of even greater significance in future since television is an extremely expensive service. Thus post-war problems will be largely economic and must be considered in conjunction with allied subjects within the framework of Government policy. Early indication of what the latter is to be would be extremely helpful.

It seems obvious to the author that for at least the first year of the recommencement of service it will be necessary for the Government to subsidise the building and operation of transmitters, but he is doubtful about how the money is to be obtained. Financial aid through sponsored programmes, licensing, outside broadcast vans, purchase tax and expansion of service area are briefly referred to before the author records his criticisms of the immediate post-war use of the old system and of changes that have been suggested.

Carrier Distribution Most Economic

Turning to factors governing means of system improvement, the author states that broadcast carrier distribution has the overwhelming advantage of economic feasibility; despite its disadvantages it is the most practicable means of satisfying the essential requirement of maximum return for minimum outlay. Choice of carrier and video frequencies is considered in relation to economic types of directive receiving aerial for reducing the interfering effects of reflected and spurious signals.

In the author's view there are unexplained differences between the definitions obtainable with interlaced and sequential scanning for a given band width, which indicates that much research work remains to be done. The author's opinion is that a picture repetition rate of twenty-five and a frame repetition rate of two is a standard from which any deviation is unlikely to bring about any worth-while improvement. He deems it necessary to explore the limitations of transmitters, pick-up tubes (the sensitivity of an orthicon being about ten times greater than that of an ordinary iconoscope), magnetic and electrostatic scan-generators (possible improved efficiency of the power-oscillator type may prove to be an economic solution) and picture-tubes (direct-viewing receivers); possible final solution of the problem of projected television pictures may be some form of cathode-ray-controlled light valve.

The conclusion is that it is unsound to argue in favour of the immediate restoration of the pre-war system because of the possibility of absorbing a large proportion of the technical personnel at present engaged on war work of a similar nature. Resumption is unlikely to have that result, unless an immediate expansion of the old system to the provinces is envisaged. The author views such proposals with the greatest apprehension, because they invariably mean saddling this country with an old system for many years, ultimately resulting in diminution of British lead in television and, consequently, loss of an important export trade, besides giving the public an indifferent service, which would react unfavourably upon the whole future of television in this country.

Introduction of New System

Assuming the Government's attitude to be progressive, in so far as immediate economic factors will allow, two possible alternatives present themselves. First, concurrently with research directed to the development of an improved system, to recommence transmission on the old system for five years only; after two years a new system could be introduced experimentally for one year, at the same time manufacturers would commence to market receivers suitable for the improved service. At the end of three years both systems would function simultaneously, radiating the same programme, which would be essential financially; manufacture of old-type receivers to cease upon establishment of the improved service. Thus there would be two years in which to write off the cost of receivers purchased even so late as three years after the post-war resumption of service.

The second alternative would be to commence with an improved system within one year of the termination of the war, which may seem unreasonable, but when compared with some schemes of far greater magnitude that have been carried to successful conclusions in less than a year (under conditions of great difficulty during the war) it is the author's opinion that a television scheme could be dealt with within twelve months, and lay the foundations of a progressive industry.

The war has speeded up the tempo of radio research and trained in electronics many physicists and engineers who would be available for television work and the staffing of factories. One must not mistakenly judge future capabilities of achievement by pre-war standards of development.

Domestic Apparatus–I

Conditions Affecting Manufacture after the War

WHILE electrical manufacturers are at present engaged wholly on work connected with the war, and must continue to be until victory is achieved, they must not be caught unprepared for the difficult transitional stage between wartime and peacetime production; it is of the greatest importance to the nation that the change-over of manufacture should be effected as rapidly and smoothly as possible. For those producers who are in the fortunate position of making the same type of article in both peace and war the transition may not be too difficult, but any number of problems will confront those whose normal activities have been restricted or even discontinued, especially makers of domestic appliances.

Several manufacturers, notably the largest ones, have more or less definite plans of action—as definite, that is, as uncertainties regarding the Government's policy, the position relating to materials, labour, etc., permit. Generally, however, shortage of staff, time and materials have prevented all but the most cursory study of the question. Both E.D.A. and B.E.A.M.A. are, of course, actively engaged on work connected with the problem and have made considerable progress. In the meantime we propose to give in this and subsequent articles a brief survey, not only of the probable manufacturing conditions at the conclusion of hostilities, but also of the probable demand for appliances and the trend of design.

When the war is over electrical manufacturers will be faced with the change-over to peace-time production. In this article we try to visualise the sort of situation and problems that will confront them

Unprecedented Demand

Immediately after the war, as soon as restrictions are eased, there will be a demand for electrical appliances surpassing immeasurably anything the industry has had to face before. Apart from the general demand for an improved standard of living, housewives, having learned from their work in factories and from having to do without maids to appreciate the merits of electricity, its efficiency, cleanliness and safety, will want to take more and more advantage of it in their homes. Electrical appliances will no doubt be required for all the four million or so new houses which it is proposed to build, as well as in pre-war premises.

How quickly these requirements can be met rests in the first instance on the attitude of the various Government Departments concerned. The speed with which the relaxation of controls is brought about is of the utmost importance, and if manufacturers are to be able to make concrete plans it is imperative that they should be given some lead, not only with regard to the probable availability of materials, but also as to the future policy relating to Limitation of Supplies and the purchase tax, both of which have an effect on the class, type, quality and price of the apparatus to be produced.

If, as seems probable, the purchase tax is continued, it may well be that it will be made to differentiate between "essential" and "luxury" apparatus. A similar degree of control might be effected by the manipulation of the Limitation of Supplies restrictions which will presumably be speedily lifted in the case of the more essential appliances but might be continued for the "luxury" class of goods. There may be a difference of opinion as to which appliances are essential and which are not. Refrigerators, for example, may be considered either. It does seem likely, however, that "priorities" will not be given in the first instance to such appliances as toasters, coffee percolators, hair dryers and the like.

Manufacturers would also like to know how long the licensing system instituted by the Electrical Appliances (Control of Manufacture & Supply) Order is likely to be continued. It has a vital bearing on the plans of firms wishing to produce new lines, and it might be retained for a while as a means of assisting pre-war concerns to get into production before opening the market to newcomers. Incidentally, too, this and other controls now in operation might provide the means to scotch the producers of shoddy appliances, which are a constant source of danger and ill repute. Another question to be raised is whether some sort of assistance or preferential treatment will be given to manufacturers whose plant has been damaged or destroyed by enemy action. Furthermore, the Government's policy regarding exports will largely influence manufacturers' decisions.

Who Will Place Orders?

Before production plans can be completed some idea will have to be obtained of the marketing arrangements. It is important to know what type of appliances will be required; who is going to place the orders for the appliances—the Ministry of Works, the local authorities, builders or supply authorities; and whether there will be bulk purchasing. This matter of bulk purchasing, though admittedly facilitating (but not essential for)

mass production to a certain extent, is not looked on with favour by most manufacturers who consider that it would stifle progress. They would certainly oppose the scheme, but if it were adopted it would inevitably mean much closer co-operation between manufacturers in their own interests and also the pooling of ideas.

Hire or Hire-Purchase?

If there is a return to hiring of apparatus after the war, this will affect design to a certain degree. A number of electricity undertakings, however, would like to eliminate hire and have hire-purchase or outright purchase only, the chief argument for this being that consumers take more pride and greater care of apparatus if it is their own property, thereby reducing maintenance costs. The opinion has also been expressed that now that electricity has proved its worth there is no need to provide the inducement of hire to potential users. Perhaps hire might be employed as a transitional measure for use with pre-war apparatus, hire-purchase being reserved for new apparatus.

Should gas undertakings decide to provide hire facilities, electricity undertakings will probably have to follow suit. In any case, it is ever-improving electrical service rather than apparatus that it will be the object of undertakings to supply, and they may eventually decide that hire provides the best means of achieving this.

The type and construction of houses to be erected after the war will influence the design of appliances to a great extent. Prefabrication looms large in the picture, as well as the building-in of appliances. Both features necessitate at least some sort of standardisation of dimensions, if not of complete appliances, and before this is definitely settled no real progress can be made. For satisfactory kitchen planning it is not sufficient to have the height of such equipment as cookers, washing machines, etc., standardised but also their width and depth as well. Architects and builders will want to know what recess space to leave for built-in apparatus, this necessitating the fixing of all external dimensions. The probable habits of the dwellers in the post-war housing estates will also have to be considered, whether, for instance, they will favour communal restaurants and laundries.

Transition Period

Only when all the preliminary details mentioned and many more besides are settled will manufacturers be able really to get down to business. Given the requisite material and labour, almost all manufacturers, except those unfortunate ones whose plant has been damaged or destroyed, anticipate that they could change over to their peacetime production of pre-war models within a very short time.

In almost all cases manufacturers will revert to pre-war designs at first, in order that they can get back into production as rapidly as possible. While there seems to be a heaven-sent opportunity for developing new lines, this reversion is felt to be desirable for a time for several other reasons. In the first place there will be such a tremendous demand immediately after the war that it will be out of the question for manufacturers to postpone placing apparatus on the market until their new models materialise.

There need be no despondency about this: the 1939–40 season's models were only on the market for a very short time and though, of course, improvable they were highly efficient and did not have any serious defects. To produce them manufacturers will be able to use their existing tools and methods; obtaining new ones means delay. Furthermore, manufacturers as a whole are determined that consumers shall get the best possible appliances available and new models must first be properly tried out under actual working conditions; factory tests are not sufficient. Normally it is reckoned to take a year to get a new line on the market.

Marketing Existing Designs

The suggestion from some quarters that a return to pre-war designs would be very damaging to the industry need not be taken too seriously. Far greater harm would be done by putting new and untested types of apparatus on the market prematurely. In the period immediately after the war some customers, however, may be disinclined to purchase apparatus that may become obsolete within a very short time, but this will not be disadvantageous if it places some check upon the deluge of orders which may be expected immediately after the war.

While it seems fairly certain therefore that manufacturers will initially concentrate on their pre-war designs, no doubt minor alterations will be incorporated. The break in production due to the war will give makers a chance to discontinue any of their less popular lines and confine their production to a comparatively small number of models—a policy which though favoured by the works has never had the full support of sales departments.

It is estimated that this transitional stage before new appliances start to make their appearance on the market will last somewhere between six and twelve months. As during this time the demand for apparatus will be almost entirely for installation in existing premises the lack of standardisation of dimensions and building-in facilities in the equipment available will not be of such importance as it will be in the case of new homes.

If the time taken to erect agricultural workers' cottages is anything to go by, the new houses will certainly not be ready before the new types of electrical apparatus start

coming off the production lines in large quantities. Thus, while the potential market may be greater in new houses, the immediate market will be in existing homes. The probability of a " breathing space " between the end of the war and the time when the erection of new houses begins should not, however, be regarded by manufacturers as an excuse, if one were necessary, for postponing making their plans as complete as they can. As it has been throughout the war, the electrical industry must be at least abreast if not ahead of demand.

In our next article we shall endeavour to forecast what will be the electrical requirements in post-war homes.

Restoring Liberated Areas

Where Will the Plant Come From?

CONSIDERATIONS entering into the supply of plant for the rehabilitation of public utility services in liberated areas are discussed in a recent issue of the *Electrical World* (New York). The matter is in the hands of a Public Utilities Committee comprising Mr. J. A. Krug (U.S.A.), Sir Henry Self (Great Britain), and Dr. T. H. Hogg (Canada), whose duty it will be to decide what is needed in the liberated areas and whence it is to be obtained.

Our contemporary points out that the success of any programme will depend upon the degree of co-operation secured from all the interests involved. The help of American manufacturers will be needed in meeting the technical problems involved, and of the greatest importance will be the relations between Great Britain and the United States, as well as between the numerous United States agencies concerned.

Further, relations with American power systems, public and private, which have been on short rations of equipment for some years and may object to a continuance of this while the wanted equipment goes overseas, will have their effect on the programme. " The feeling is that, with careful management, there will be ample manufacturing capacity to supply both the rehabilitation programme and a reasonably prompt return to normal operation by the American power industry." The insistence on rehabilitation only to the point of minimum service will, it is believed, prevent too great a drain on American manufacturing capacity.

" Excess Stocks "

" The British are known to have a list of minimum service standards already drawn up, but it is not known to what extent they will jibe [*i.e.*, agree] with determinations by this country of what is needed and feasible." At least some of the material to be used will come from the excess utility stocks in the United States and Great Britain. " The British, for their part, are known to have built up ' blitz ' stocks for prompt re-establishment of service after German air raids. To what extent these will figure in the rehabilitation will depend largely upon the British feelings as to the likelihood of further air attacks."

" The rehabilitation programme presents an opportunity for American producers to get business of which they have not heretofore taken a major share. Competition between British and U.S. firms for this business will almost certainly arise, and the resolution of that competition will rest in the new committee, which is charged with determining the source of the rehabilitation material."

With regard to the financing of the plant programme, our contemporary says that this will apparently be " business-like." It is known that where dollar balances are held in the United States by recipients of the relief payment will be made from such balances. Where no such financing is possible " easy credit " will have to be made available, but it is the intention of the Foreign Economic Administration at least to obtain payment wherever possible, even though that payment be delayed for some time.

Outdoor Milking Bail

THERE must be many users of outdoor milking bails who would be glad to dispense with petrol engines and use electricity instead. Yet, because the bail must be mobile, and is often situated far from a supply point, the use of electricity seems out of the question. Mr. W. W. Ringer, of Sedgeford, Norfolk, has, however, solved the problem by using a small electric battery vehicle to provide the necessary power.

The outfit is a six-stall one, with automatic recorders, semi-automatic feeders, and three milking points, each having a special five-way tap to control recording, milking, cleansing, etc. Mounted on pneumatic wheels it is moved about the fields in the ordinary way. At one end of the bail is a dairy, and at the other Mr. Ringer has installed an electric motor to drive the machinery. At milking time the electric vehicle, bringing the men, is run alongside the outfit and the electric motor in the bail is connected to the batteries. The storage capacity of the accumulators is more than sufficient for the morning and afternoon milkings, at each of which about sixty cows are handled. When milking is finished the truck is used to run the churns to the station and on the way back it calls at the farmhouse to pick up any supplies that are needed. The batteries are charged during the night.

Canadian Water Power

Record Expansion in 1943

THE largest amount of new hydro-electric plant ever installed in Canada in any one year was completed during 1943. During the four years 1939-42 the programme of development resulted in the addition of more than 1,750,000 HP of plant, while last year the record installation of 1,002,273 HP was achieved. The latter figure includes three units transferred to newer stations and certain other adjustments, so that the net gain was 810,973 HP. This makes the total hydraulic development of the Dominion at the beginning of this year 10,034,513 HP. Great as this installation is, it still leaves more than 80 per cent. of the country's water-power resources untouched. The total output for 1943 is estimated to have exceeded 40,000 million kWh.

The following description, by provinces, of the principal hydro-electric activities last year has been prepared by the Dominion Water and Power Bureau, Department of Mines and Resources, Ottawa:—

British Columbia

The West Kootenay Power & Light Co. (Consolidated Mining & Smelting Co.) proceeded with the construction of its new generating station at Brilliant on the Kootenay River. Two turbines of 34,000 HP each are now being installed, with provision for two similar units later. This is the company's fifth station on the Kootenay River and its full installation in conjunction with those of the other four plants will provide a total of 414,000 HP and result in the complete utilisation of the power possibilities of the river. The Consolidated Mining & Smelting Co. is also carrying on preliminary work on a power site on the Nation River in the Cassiar District to provide power over a 60-mile transmission line to its Pinchi Creek mercury property.

Ontario

The Hydro-Electric Power Commission of Ontario, which generates 75 per cent. of the power produced in the province and which also imports large amounts of power from Quebec, completed and formally placed in service on October 15th its second generating station at DeCew Falls, which is supplied with water from Lake Erie through the Welland Ship Canal. This additional water became available to the Commission through the construction of the Ogoki and Long Lake diversion projects. The installation consists of a 65,000-HP unit transferred from the Abitibi River station operated by the Commission. The Commission also proceeded with the construction of the remedial weir above Niagara Falls. This weir, built under agreement between Canada and the United States, is for the purpose of providing improved conditions for the generation of power in the war emergency and for restoring and maintaining the scenic beauty of the Falls. The Ogoki River diversion project was completed and officially opened on July 20th. This project, by which the flow of the Ogoki River is diverted from the James Bay to the Lake Nipigon—Great Lakes—St. Lawrence River drainage, together with a previously completed diversion from Long Lake, provides an additional power potential of 360,000 HP in the Great Lakes—St. Lawrence waterway system.

The Commission installed additional transformer equipment aggregating more than 175,000 kVA at various points in the province and constructed a 110,000-V transmission line 120 miles in length from Port Arthur to the Steep Rock Iron Mines. This line will provide power to operate the pumps which will drain an estimated 100,000 million gallons of water from Steep Rock Lake to facilitate the recovery of iron ore beneath its bed.

Quebec

More than 56 per cent. of Canada's developed water power is installed in Quebec province. Canadian production of aluminium, now six times greater than in 1939 and exceeding the total world production in that year, is entirely confined to the province. Here, bauxite brought from British Guiana and cryolite imported from Greenland are reduced to metallic aluminium by a process requiring great amounts of power. The Aluminum Power Co. completed during 1943 its great Shipshaw station on the Saguenay River. The addition of ten units of 85,000 HP each (two of which were transferred from the company's lower-head plant at Chute à Caron) brought the installation to 1,020,000 HP, a figure which is expected to prove considerably larger on final test. The installation of this plant is almost double that of the next largest Canadian development, and, in conjunction with the other Saguenay River developments of the Aluminum Power Co. and its associated company, Saguenay Power Co., it will provide power for the immense aluminium plant at Arvida, the largest in the world.

Additional power for the Shawinigan Water & Power Co.'s system has been provided by the installation of two new units on the St. Maurice River. One of these (40,000 HP) increases the capacity of the Rapide Blanc generating station to 200,000 HP; the second (44,500 HP) increases that of the La Tuque station to 222,500 HP. The company also constructed a 60,000-V line from St. Vincent de Paul to connect its transmission system with the generating station of the Montreal Island Power Co. on Prairies River.

New Brunswick

No new hydraulic installation was in progress in New Brunswick during 1943, but the Electric Power Commission completed the installation of a new 7,500-kVA steam turbine in its Grand Lake station on May 1st. The installation of the station now totals 20,000 kVA.

Nova Scotia

The Nova Scotia Power Commission completed development of a small station on the Medway River at Eel Lake and the Nova Scotia Light & Power Co. continued work on the addition to its Halifax steam station, but tardy delivery of equipment delayed its completion.

Immersion Heaters

Application to Industrial Processes

By R. W. J. Cockram, A.M.I.E.E.

DURING pre-war years the domestic immersion heater had been developed to a high degree of efficiency and, both in the hand and automatically controlled versions, could be relied upon to give many years' service with negligible maintenance cost. Since the beginning of the war this apparatus has been successfully applied to industrial processes by suitable modifications to meet the design requirements in this field.

The conventional form of immersion heater consists of watertight cylindrical heating elements which can be inserted into the normal household hot-water tank. The element tubes are held at one end by a housing, which also forms the base of the terminal box. The latter embodies various forms of terminal gear and also provides accommodation for a thermostat where automatic control is required.

For industrial applications the following conditions must be provided for: Rugged construction; submersibility of the complete apparatus; resistance to corrosion; and high loading values. Designed for placing in the conventional hot-air cupboard, the domestic immersion heater was found to be insufficiently robust for most industrial applications. Where previously the heaviest object likely to be dropped on it was a blanket, now 2-in. spanners and the like have to be withstood, not to mention the possibility of the heater head projecting from containers at almost floor level in most vulnerable positions.

Increased protection for terminal gear is required to meet two general sets of conditions. The first, for normal industrial applications, may consist of a heavy-gauge brass spinning. In the second case the terminal box needs to be watertight in order that the complete unit may be submerged in liquid; it then takes the form of brass castings that provide accommodation for a metal terminal bar having refractory insulators, thus replacing the comparatively fragile bakelite moulding previously used.

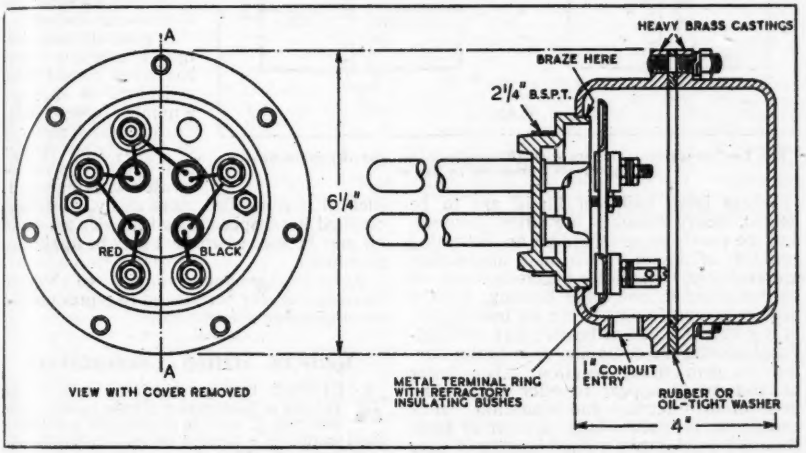


Fig. 1.—Design of terminal head for submersible heater unit

Cable entry for submersible forms is provided for by a boss moulded into the casting, with a hole to give facilities for direct conduit connection. Terminal gear depends considerably on loading and application. Cable fixing arrangements are usually of the surface pressure or pinching screw types. A quick-release feature is furnished in the former type by locating the connecting wires in a slot in which they are held under pressure of a nut and washer. Removal can thus be easily effected by slacking off the nut and withdrawing the wire.

Where heaters are used in easily carbonised liquids of high viscosity, such as oil pitch and creosote, special precautions are necessary to

prevent corrosion of the element protecting tubes. The permissible watts density for the surface of the heating element depends upon viscosity values at normal temperatures with a maximum of 17 W per sq. in., which permits slow convection currents to carry away the heated liquid for replacement by liquid of lower temperature. Even under these conditions tinned copper is unsuitable, and solid-drawn, heavy-gauge steel tubes are required.

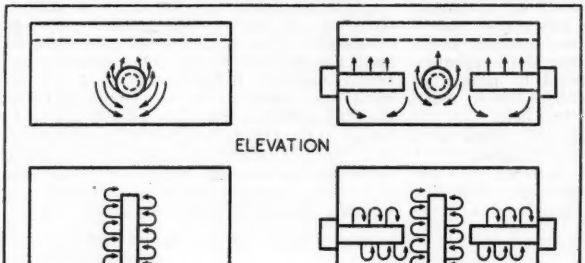


Fig. 2.—Convection currents with (A) single-heater and (B) multi-heater elements immersed in liquids

Where large bulks of liquid are to be heated, heavy loadings are often involved, and the provision of this raises an interesting problem of design. Two main alternatives are available. The heating elements may all be contained in one large housing, thereby providing single-point fixing on installation, or a group of standard heaters may be distributed around the container, each heater having its own fixing location. The latter method would appear to offer advantages, both in manufacture and operation. It is cheaper to produce a large number of small standard articles than a small number of large equipments of special design; hence production costs are lowered by designing to a versatile standard unit which may be used in multiple.

Improving Heat Distribution

In the second place, with large bulks of highly viscous liquid better heat dispersion may be obtained by supplying heat at widely distributed places. This method reduces the travel of convection currents, thereby securing quicker and more efficient results. A disadvantage of the multi-heater arrangement is in the greater number of connections, but once the heater is in service this point becomes negligible.

For single heaters loadings up to 6 kW are convenient; this figure, being a multiple of three, is suitable for balanced conditions on three-phase supplies, giving a fundamental unit loading of 18 kW, which may be increased by arranging two heaters in parallel per phase. Alternatively, if there are six heating tubes per heater, a single unit may be balanced on a three-phase system, with 2-kW on each phase.

Chemical-vat heating has long proved a problem for electrical installations. Two methods are available. In one the vat is surrounded by a jacket containing water heated to the required temperature, thereby obviating the necessity of immersing the heating elements in corrosive solutions; in the other the elements and immersed portions of the heater have a protective lead covering similar to that used in the vat.

In general, the industrial immersion heater has given considerable assistance in speeding a number of war operations. Many methods of production require heat application for increased working speed; fuel oil is controlled more easily, containers emptied more speedily and heavier grades of oil may be used where heat may be applied to pipe lines.

Acknowledgements are due to Messrs. Santon, Ltd., for permission to reproduce the accompanying illustrations.

Railway Station Loudspeakers

A DEVICE that automatically adjusts the volume of loudspeaker groups in relation to the level of noise in the vicinity is the principal feature of a modern public address system just completed at the Liverpool Street station of the London & North Eastern Railway to replace that installed in 1937. The new installation has been specially designed by Central Rediffusion Services, Ltd., in co-operation with the L.N.E.R. Chief Engineer's Department to overcome acoustic and other problems arising from the heavy volume of traffic. These problems have been met by directing beams of sound down each individual platform so that speech is not audible on adjacent platforms; by giving a wide angle of diffusion of speech in the circulating areas; and by varying the acoustic power fed to each group of loudspeakers so as to meet changing noise levels, this being effected by the provision of automatic volume control circuits of novel design.

The installation comprises no fewer than 123 loudspeakers of waterproof construction and resistant to the effects of humidity and sulphur and soot corrosion.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Committee of the North-Midland Centre of the Institution of Electrical Engineers has nominated **Mr. E. Lunn** as chairman for 1944-45, with **Messrs. A. Kelso** and **E. S. Ritter** as vice-chairmen.

Mr. George Claughton who, at the age of sixty-nine, has just retired from the position of power station superintendent at the Brighton Corporation's Southwick station which he has held for thirty-eight years, was the guest of honour at a social and concert attended by nearly 500 members of the Brighton Electricity Social Club at the Royal Pavilion. He was presented by Councillor Alfred Rostance, chairman of the Corporation Public Utilities Committee, with a long-service certificate, and by Mr. H. Pryce-Jones, borough electrical engineer and manager, with a cheque from members of the staff. Mrs. Claughton was presented with a book.

Mr. S. C. Laws, M.A., M.Sc., principal of the Northampton Polytechnic, was due to retire on February 5th, but the governors propose to re-appoint him for a period not exceeding one year.

Dr. H. R. Ricardo, the well-known authority on high-speed internal combustion engines, has been elected president of the Institution of Mechanical Engineers.

In his second Keith Lecture on "Rail Traction" to the Royal Scottish Society of Arts in Edinburgh, **Mr. W. I. Bride,** Lecturer in Engineering at Heriot-Watt College, said that the desire for cleaner towns in the future would strongly favour the use of electric, or possibly Diesel-electric, traction.

Mr. J. R. Smith, M.I.E.E., gave a paper on "Temperature Control" to an audience of boiler house operatives and administrative personnel at Cambridge on February 15th. The object of the paper was to bring to the notice of fuel users the advantages of thermostatic control. Mr. Smith is district engineer for George Ellison, Ltd., and a member of the Ministry of Fuel and Power's Fuel Efficiency Committee Eastern Region.

Over 2,000 employees of Philips (Blackburn) Works, Ltd., attended a dance at Blackburn Public Halls, on February 18th, to celebrate the sixth anniversary of the opening of the factory. Mr. J. Visman, managing director, referred to the splendid achievements of the year, and said he shared the hope that, before the next party, the war would have ended. The future of electrical development would be very great, he said, though the transition period would be difficult and require all-round co-operation. Prince Bernhard, of the Netherlands, last Friday made a tour of the factory.

Mr. Frederick W. Good, assistant electrical engineer with the City Corporation of Wellington, N.Z., has retired on reaching the age of sixty-five. The *New Zealand Electrical Journal* states that he was one of the city's pioneer electrical engineers, having served with the undertaking for more than thirty-eight years, first with the Gulcher Company and then with the Corporation which took over the system. Mr. Good was born at Beer, Devon, England, and on leaving school he served for two years on the electrical staff of Cardiff Corporation. He then went to Durban, South Africa, where he was for four years shift engineer with the Natal Government Railways. After a period with Durban City Council as testing electrician and assistant mains superintendent, he went to Wellington in 1905 to join the Gulcher Co.

The 1943 report of the English Electric Co., Ltd., mentions the retirement of **Mr. H. T. Rice** from the board after forty-three years' service with the company and its predecessors. He is being retained in an advisory capacity.

Mr. A. Wallworth, chief commercial clerk of Oldham electricity undertaking, has just retired.

Mr. J. Peers has been appointed advertising manager of the Industrial & Engineering Development Association. For the past four years he has undertaken similar duties for Bennis Combustion, Ltd., and was editor of the Bennis technical journal *Cheap Steam.*

Dr. Vannevar Bush, president of the Carnegie Institute of Washington, has been awarded the 1943 Edison Medal by the American Institute of Electrical Engineers for "his contribution to the advancement of electrical engineering, particularly through the development of new applications of mathematics to engineering problems, and for his eminent services to the nation in guiding the war research programme."

Obituary

Mr. G. J. Berry.—It is with very great regret that we learn that Mr. G. J. ("Tim") Berry, chairman and managing director of Berry's Electric, Ltd., was killed by enemy action at his home last week. We also regret to report that his wife and daughter were badly injured at the same time and are now in hospital, but according to the latest information are not believed to be in immediate danger. Mr. Berry, whose funeral took place quietly at Putney Vale Cemetery on Wednesday, was a member of the B.E.A.M.A. Council and served on various sections of the Association. He was the eldest son of Mr. H. H. Berry, who died in 1939.

Mr. E. G. Byng.—We regret to report the death on February 18th, at Spratton Hall, Northampton, of Mr. Ernest G. Byng, for many years a director of the General Electric Co., Ltd. He was fifty-six. The funeral took place at Northampton on Tuesday last.

Mr. M. M. Keller.—The recent death is reported from Berne, Switzerland, of Mr. M. M. Keller, chief of the Telegraph and Radio Communication Section of the Swiss Posts and Telegraphs, at the age of fifty-eight years.

Will.—The late **Dr. Gerald T. Moody,** a director of the Isle of Thanet Electric Supply Co., the Burma Electric Supply Co. and the Kalgoorlie Electric Power & Lighting Corporation, left £602,394 (net personalty £575,437).

Drying Out Transformers

Notes on Procedure for Air and Oil

IF there is any chance of transformers having absorbed moisture during transit from manufacturers' works to site, a drying-out run, preferably in air, may be necessary. The core and windings should be heated to about 90 deg. C, no internal or local part of the windings exceeding 100 deg. C. Ventilation should be provided to allow the escape of occluded moisture. Alternatively, the transformer may be dried out in its oil at an oil temperature of approximately 90 deg. C, but this takes appreciably longer and throughout the process it is desirable that the hot oil should be continuously circulated through a filter.

In either case, readings of insulation resistance should be taken at frequent intervals. The run should be continued until the readings have passed through a minimum value and have shown a rising tendency for several hours with the temperature of the transformer remaining constant. If, after the transformer has reached its drying temperature, the insulation resistance remains stationary for twenty-four to forty-eight hours at a value, when oil-immersed, of not less than about one megohm per kV with a minimum of 10 megohms, it may be considered to be dry; in air the values should be about four times greater. If the short-circuit method of heating is used the transformer must be connected on such tappings as will ensure uniform heating throughout.

Temperature Indications

For air drying, a current that depends on the size and characteristics of the unit (but considerably less than full load) is circulated to maintain the desired temperature. Several thermometers should be so placed as to indicate the hottest accessible parts of the windings, the interior parts of which may be 10 to 15 deg. higher. Heaters placed round the transformer will assist in preventing condensation upon exterior surfaces of moisture driven off from the interior.

When drying out a transformer in oil the tank should be lagged and, if current is circulated with one winding short-circuited, the oil temperature should be limited in order to avoid excessive internal temperatures as follows:—For 125 per cent. of full load, 80 deg.; for 100 per cent., 90 deg.; for 50 per cent., 100 deg. If drying temperatures cannot be regulated by adjusting the circulating current, switching on and off at intervals should be resorted to so that the temperature rises and falls about the desired value. As insulation resistance varies with temperature, readings must be taken when the temperature is at a definite and fixed value in order to avoid masking the stage when the upward trend commences.

Other methods of heating include the use of an oven heated by radiators, circulation of the oil through an external heater and heating the oil by immersion heaters or resistance grids dropped to the bottom of the tank between the unit and the tank walls. Any method must avoid excessive local heating of the oil and the process must be kept under continuous observation. Acknowledgements are due to the British Electric Transformer Co., Ltd., for supplying the above data.

Mediterranean Cables

Restoration by Allied Troops

BRITISH and American troops have restored the entire North Africa–Mediterranean cable system. How this extensive communications system has been built up was told to *Reuter's* special correspondent by the chief signal officer, Major-General L. B. Nicholls. In Naples, he said, the Germans destroyed all the communications with technical precision. They estimated that long-distance communications could not be restored on a general scale within six months; actually it took three weeks to establish a service. Practically all the main routes are by underground cables, with a booster in a manhole every 1,000 metres. The Germans cut the ends of the cables at the boosters, flooded them, and let the water seep along the cables and render them useless. In some of the manholes they left booby traps. British, Americans and Italians, covered in grease and dirt, working side by side, have joined these cables up. In Naples itself there was a 20,000-line automatic exchange in a seven-storey ferro-concrete building, which the Germans blew up. Men of the Royal Corps of Signals diverted the cables, inserted new exchanges, and there is now a limited automatic telephone service working in the city, with Italian operators supervised by British and Americans.

The system from Naples to Milan was installed at a cost of £3,000,000 nine years ago. The chief engineer on the original job was Lieut.-Col. G. A. Keith, who has now been at work restoring the service.

All the telephone resources which the Royal Corps of Signals found in Algiers was a French exchange. It has built and re-built routes right down to Tunisia, Tripoli, Sfax and Sousse. It has 40 subsidiary exchanges in addition to the main exchange.

The Signals organisation now controls its own factories. It took over one derelict French factory which is now producing 250 tons of copper wire a month. Another works in North Africa is making 30,000 glass insulators a month. The cross-arms for telegraph posts are made from local forest timber. By careful planning and development of local resources a considerable amount of shipping is being saved.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

House Wiring Schemes

REGARDING Mr. D. P. Wilson's letter in your issue of February 11th, my experience has been that the location of the switch-plugs for lighting and power was always regarded as a vexed question for the householder. I have found that in addition to the difficulties expressed by Mr. Wilson, the dollies of the switch-plug, both on-the-surface and flush types, were very prone to damage by the moving of furniture or accidental knocks during the cleaning of the room, and I have replaced many otherwise perfectly sound fittings solely for this reason after a short time in service.

I have traced a number of "earths" on installations to the fitting of switch-plugs to skirting boards affected by faulty dampcourses or poor ventilation under the floor at ground level.

By adopting Mr. Wilson's suggestions, these additional difficulties could be easily overcome on new installations without incurring great expense on existing installations when it was found necessary to replace a switch-plug.

Loughborough. R. W. RAPSON.

Post-War Economy

IF post-war prosperity is to be constant and universal, then it will be necessary to establish a firm and solid basis to enable goods and services to be efficiently exchanged both within nations and between nations all over the world. To make this possible the principal requirements are steady purchasing power in the hands of the populace, regular demand for goods, and the necessary capacity to produce the goods, along with an adequate labour force.

It is advisable to establish an adjustment between supply and demand. This can be controlled by industrial groups regularly checking sources of supply in proportion to the probable demands for the different types of goods required. During the transition period it will be necessary to continue rationing and price control, but a gradual relaxation is advisable. The present standard of living should be taken as a basis and a slow process of increasing real wages and real income by gradual decreases in costs and retail rates should give the public an opportunity of securing the best possible value with continually developing demand.

A special effort must be made to substantially increase our export trade, and with this in view constant technological improvement in the production of new commodities must continue at a high level. With a very large proportion of our overseas investments liquidated, we shall be forced to substantially increase the volume of our exports.

On the other hand, in order to meet the general demand for a higher standard of living, certain kinds of public work might be undertaken, but particular care must be taken that no schemes which lead to unproductive and wasteful spending are allowed to be formulated, or any programme carried out that is likely to cut into the proper field of private enterprise.

Money or currency has made the exchange of goods and services possible, by providing a recognised symbol for every kind and type of wealth. The possession of monetary value or credit assures the power to call for goods or services, or both, as they are required. A basis of barter, which appears to be the only alternative, is unsatisfactory and creates almost insurmountable difficulties and conflicts.

In order to secure great and efficient production, the power of the State should be utilised to regulate and control, without in any way sacrificing the great spirit and driving force of private enterprise.

Among other matters, we must secure and liberally remunerate the best brains for development and research and arrange for adequate outlay on these important activities, to keep each particular industry in the forefront of world technique and invention. We must also ensure a fair return to those who risk their money in support of enterprise, by investment in commerce, industry, and development generally.

Manchester. A. A. GOLDSTONE.

Views on Reorganisation Memoranda

THE St. Pancras Electricity and Public Lighting Committee reports that it has had under consideration the memorandum issued by the I.M.E.A. and that produced jointly by the municipal and company associations with regard to the future organisation of the industry.

The Committee is of the opinion that, while the proposals may represent a form of organised co-operation within the electricity supply industry which may be of some mutual benefit to the industry and consumers of electricity, the scheme does not take into account the rightful part which, in the Committee's opinion, electricity should take in a national fuel policy aiming at the most economical utilisation of energy in all its forms. For this reason the proposals are considered to render but little assistance to national interests, which should be of paramount importance.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Self-Locking Plugs

A NEW type of plug locking device, produced by CLIPPER CONNECTORS, LTD., 93, Church Road, Hendon, N.W.4, can be applied to any type or size of plug and socket with any number of poles. The device is claimed to open up new possibilities for the suspension of lighting fittings, tools, etc., from plugs in the ceiling or overhead busbars, while a special point with regard to flat-pin plugs is that even a single-pole unit has a firm grip in its socket. The contact secured in all types is

Three-pin "cat's paw" type connector with retractable contact pins, and (right) self-locking standard 5-A plug and socket. The diagrams show the method of locking on the earth pin of a three-pin plug and socket

said to be superior to that of the customary plug and socket, and in the case of three-pin 5-A plugs not only can existing sockets be adapted to take the special plugs, but the latter will fit into any standard socket (without locking of course). The self-locking mechanism of this plug is contained in the earth pin.

The essential components are a clamping rod (reminiscent of a shortened crochet hook with the hook closed up), a wedging stud and a spring. The first two items have been developed by the company in co-operation with Herbert Terry & Sons, Ltd. When the clamping rod is pushed into the socket hole, the wedging stud is pressed backwards against the action of the spring. On locking, the clamping rod is displaced sideways and allows the wedging stud to snap into the socket hole. Separation is impossible except by shearing, and the spring presses the plug contact into the socket cup. Pulling on the plug (or a particular portion of the plug in most cases) lifts the wedging stud until the clamping rod is free to pass the socket hole, and the connector snaps apart. Thus the contact is not purely frictional, but is under a definite spring loading which can be adapted to suit specific requirements. It is, for example, possible to make the springs sufficiently strong to prevent small children pulling out the plugs.

Some of the connectors, the "cat's paw" types, are so designed that the contacts protrude only when the plug has been pushed in, thus giving complete shrouding the whole time. In the case of the three-pin plugs the locking device is incorporated only in the earthing pin, and a special feature of the "cat's paw" types is that arcing is reduced to a minimum.

Pressure Switches

Pressure switches for controlling electrically driven air compressors, which are now being manufactured by REAVELL & CO., LTD., Ranelagh Works, Ipswich, operate on a rather different principle from those already on the market. The latter are usually driven by a diaphragm, bellows, or Bourdon tube, whereas the RM-type converts variations of air pressure into mechanical movement by means of a freely floating piston in a cylinder, moving against the pull of a pair of long and lightly stressed springs. In this way quite a small difference of pressure can be arranged to cause a long piston travel, which movement is transferred through the piston-rod crosshead to another rod carrying two tappets. These can be moved independently up and down so that the switch may easily be set to cut in or out at any desired pressure within its range. The maximum air pressure for which the controller is designed is 160 lb./sq. in. and the minimum is 4 lb./sq. in.

The piston is hand-lapped to its cylinder to prevent leakage of air without interfering with its freedom of movement and, since both are made of naval brass, variation of the ambient temperature should not alter the fine fit.

The electrical portion of the controller is a 10-A mercury switch of the protected type when spark suppression is desirable; otherwise a single-pole tungsten switch is normally recommended, its large air-break gap and very quick action minimising sparking even when controlling a large DC motor starter. It is suitable for up to 550 V. With the exception of the stainless steel piston rod, internal parts are dull plated and the whole mechanism is enclosed in a substantial cast-iron case for wall fixing. The hinged front door is packed to exclude dust and dampness, a glass window being fitted in its upper part.

Colliery Electrification

Points from the I.E.E. Discussion

THERE is much in common between the transmission and distribution of electricity in coal mines and in other large industries. The majority of the aspects dealt with by Mr. B. L. METCALF in his recent I.E.E. Transmission Section paper (*Electrical Review*, February 11th) are, therefore, of interest to many more electrical engineers than are primarily concerned with coalfield problems. There was, for instance, the design of overhead line developed to meet the severe ice loading experienced in the hilly country of South Wales. In the course of the subsequent discussion Mr. C. O. BOYSE (Callender's) expressed doubts as to whether the design for $\frac{3}{4}$ in. loading, instead of $\frac{1}{2}$ in., could be provided at a reasonable cost. Mr. J. R. HARDING, however, while criticising the author's design of cross-arm supported him in his view that the Electricity Commissioners' Regulations should be revised to take account of increased ice-loading at different altitudes. The cross-arm was also criticised by Mr. H. WILLOTT TAYLOR (Edmundsons) as being far too strong for the wooden pole. It would be better, he believed, to spend more on erecting a good H pole for security. He did not claim that the standard designs of Mr. K. L. May and himself (*I.E.E. Journal*, 1943, 90, Pt. 2) were the best under every possible condition.

Flame-proof Equipment

Mr. R. C. ANDERSEN (Electric Transmission, Ltd.) submitted that transmission-line design should be governed by overall voltage cost per annum. Greater standardisation had been reached with flame-proof mining switchgear than with any other industrial gear, Mr. C. CLULEY (Metropolitan-Vickers, Co.) stated, and this he believed to be due primarily to the necessity for a flame-proof certificate and the willingness' of users to accept a minimum of attachments. He thought that none of the switchgear on the market to-day complied with the proposed new regulation forbidding exposure of live parts to atmosphere where flame-proof enclosure was prescribed. Earth-fault protection, he held, was more important on low- and medium-voltage than on high-voltage systems owing to the greater difficulty of maintaining fault current large enough to operate the relays.

Earth-leakage protection was referred to by MR. J. A. B. HORSLEY (who opened the discussion) as primarily an insurance against fire-risk in the mine and he supported the author's contention that its use was worth while below ground. He doubted, however, whether selective isolation of faulty circuits in a surface installation could be secured by h.r.c. fuses or normal overload protection. Mr. Horsley drew attention to the difference in the proportion of the total HP of motors allocated to pumping between S. Wales (18·8 per cent.), Scotland (33·2 per cent.) and the average figure for Great Britain (19·4 per cent.) and also to the extensive use of compressed air in South Wales which was responsible for an extravagant use of power as compared with direct electric drive. DR. C. J. O. GARRARD (G.E.C.) questioned whether in view of the continual advance of coal faces and probable future joining up, whether 3·3 kV was likely to remain the maximum underground.

Generation at Pits

Regarding generation, MR. H. V. PUGH (S. Wales E.P. Co.) urged colliery engineers to leave the supply of energy to those whose principal work it was. MR. A. R. COOPER (C.E.B.) remarked that a coal consumption (12,500 BThU) of 1½ lb. per kWh at the 3·3 kV bus-bars meant better fuel for the type of plant in a colliery than that which was transported many miles. In London 45s. per ton was being paid for open-cast coal. The bulk of the load and not merely the peaks should be purchased from the grid so as to obtain the full benefit of the low kWh charge. There might be a case for emergency generation using pulverised-fuel boilers capable of quick starting. In order to secure the utmost reliability underground cables might be used ultimately for colliery supplies.

Another aspect of supply continuity was mentioned by MR. D. M. RAIT (Betteshanger Colliery) who said that an interruption of more than twenty minutes caused the Ilgner flywheel set of an electric winder to lose speed, thus preventing proper lubrication of the bearings. Application of the brake to shut the set down generated so much heat that the brake could not be taken off for four or five hours for fear of fire. He contended that some of the small generating stations should be retained at collieries for emergencies, unless main stations were erected at the pit head to make use of both high- and low-grade fuels.

It was pointed out by MR. H. O. WATSON-JONES (Met.-Vick. Co.) that in 1938 the amount of fuel burned under colliery boilers was only two million tons less than that required for all public electricity supply. From half to two-thirds of the coal at present consumed at the collieries could be saved if power were produced there by centralised

high-pressure steam generating plant using low-grade fuels. While complete electrification, above and below ground, provided the only really economical way of dealing with the problem, as a part-way measure more use might well be made of the turbine-electric Ward-Leonard method of winding coal.

The need for thinking on larger lines was urged by MR. J. R. COWIE (Reyrolle's) who deprecated the use of relatively small generating blocks and referred to 300 kV or so as the bus-bar voltage of the future with 132 kV as a distribution voltage. The collieries should be dealt with as part of the national generating scheme.

In winding up the discussion MAJOR GARDINER (St. Helens Collieries) speaking as a colliery owner and engineer, emphasised that continuity of supply in regard to safety of men was of far greater importance than economic aspects, and he did not favour driving such plants as ventilating fans by electricity. He had found it advantageous to parallel his plant with the supply undertaking's system. Engineers, he said, would have to burn coal with 20 per cent. ash.

Large Three-winding Transformer

Concentric Coil Arrangement

A TRANSFORMER of well-established design of the three-phase core type which nevertheless has some special features has been made by Metropolitan-Vickers Electrical Co., Ltd., for outdoor installation.

It is of 30,000 kVA and each of its three windings, respectively for 110, 34·6 and 7 kV, is rated for the full output. The h.v. and m.v. windings are star-connected and both have tappings for ± 2½ and ± 5 per cent. of their respective voltages, connected to off-circuit switches. The l.v. winding is delta-connected and has no tappings.

High-voltage side of a large three-winding transformer

Type "ON" cooling is employed with radiators bolted direct to the tank. The reactances specified are between h.v. and l.v. 10·5 per cent., h.v. and m.v. 17 per cent., and m.v. and l.v. 6 per cent. To obtain these values the coils are concentric, the h.v. being on the outside, the m.v. on the inside next to the core with the l.v. in between the h.v. and m.v. windings. The tappings on the h.v. winding are all taken from the outer turns of the appropriate sections and are conveniently placed for connection to switches mounted adjacent to each phase. The left-hand phase switch is complete with its external insulating barrier, but on the other two phases the barriers have been removed for illustration.

The switch itself is designed for a full-load rating of 200 A, and is suitable for operation only when the transformer is off-circuit. The contacts are within a bakelite cylinder, which is supported at the top and bottom from the main yoke channels, of sufficiently large diameter and thickness to form a rigid structure and is also adequate in length to give ample creepage from the switch contacts to the ground.

The switches are actuated by shafts, which pass through oil-tight packing glands mounted on the cover, operated by hand-wheels on the top of the tank. The m.v. windings are also provided with off-circuit switches for 600 A.

The h.v. bushings are of the standard "Metrovick" outdoor condenser type, mounted on the cylindrical housings bolted on to the tank cover. The outside surface of the portion of the bushings within the housing consists of an earth band, making the housing a suitable place for mounting a bushing current transformer for protective or other purposes. The use of such a housing also reduces the height of the main cover from the ground and is often helpful in meeting load gauge restrictions. The m.v. and l.v. bushings are porcelain with through studs for connection to overhead lines.

The usual accessories include conservator, relief vent, silica gel breather, Buchholz relay, bi-directional rollers and two oil thermometers.

COMMERCE and INDUSTRY

Payments for an Installation. "Electrics" Encouraged.

Red Cross Appeal

THE eighteenth list of donations to the Electrical Industries Red Cross Appeal includes the following :—Electrical Engineers, Ltd., 8s. 7d. ; Grierson, Ltd., £3 3s. ; Christy Bros. & Co., Ltd., £10. With these amounts donations now total £6,498 7s. 1d. In addition, covenanted subscriptions already acknowledged total £11,135 15s.

Cable Makers' Wages

Revisions have been made in the classifications of occupations in the electrical cable-making industry. There will in future be six classifications for males, instead of five; the number of classifications for females remains at three. In making the revisions the Joint Industrial Council for the industry has also agreed to revise the wages of male time workers who are 21 years of age and over. The alterations take effect from and including the third pay period in March.

The new weekly rates for adult males are as follows:—District No. 1.—(1) 73s. 6½d.; (2) 76s. 5½d.; (3) 79s. 5d.; (4) 82s. 4½d.; (5) 85s. 3½d.; (6) 88s. 2½d. District No. 2.—(1) 70s. 6d.; (2) 73s. 6d.; (3) 76s. 6d.; (4) 79s. 6d.; (5) 82s. 6d.; (6) 85s. 6d. The Classification 1 rates shown are unaltered and are applicable to workers who have not completed three months' probation; after this period they receive 1s. per week extra, but this is regarded as a temporary arrangement to be considered when any general change in wages is contemplated.

Hired Wiring Rental Claim

At Ilford County Court last week the Ilford Borough Council sued a local resident, Mr. R. Dalziel, for 32s. alleged to be due under an installation hire agreement. It appeared from the evidence that the defendant was not the original hirer of the installation, which was put in in 1934, but had signed an agreement in 1943 to continue payment after he had taken over the premises.

An agent for the owner said that, when the latter bought the property, to the best of his recollection there was no indication that the wiring was the property of the Corporation. In reply to this and other points put for the defendant, witnesses for the Corporation said that there was a label on the service board stating that it was the property of the Corporation.

An inspector of the Corporation Electricity Department stated that he had called for the agreement and had said that if it were not signed he had orders to disconnect the installation and that the matter might be put into the hands of the legal department. He admitted under cross-examination that he was not sure what the Department's powers were in such a case.

The defendant's solicitor maintained that the distinction between cutting off supply and disconnection of the installation could not be substantiated. There was no authority in the Electricity Acts which authorised the cutting-off of the supply except when there were arrears on the supply account. There had been a threat and a misrepresentation.

Counsel for the Borough Council said that there had never been any suggestion that the supply would be cut off; in fact the Corporation and its officers were well aware that the supply could not be cut off.

The Registrar decided to reserve judgment. In the meantime he asked Counsel for the Corporation to consider the agreement from the point of view of how long the Corporation could charge 6s. 6d. quarterly for the installation. He would also like Counsel to address him on the point made by the owner's agent that he had no knowledge of such limitation of his freehold and that he was thus not bound by any agreement of his predecessors.

Electric Vehicles

In the House of Commons last week Mr. Butcher asked the Parliamentary Secretary to the Ministry of War Transport what steps he was taking to encourage the design and development of electric vehicles.

Mr. Noel Baker replied that the Ministry had asked the Regional Transport Commissioners to give favourable consideration to all applications for licences to acquire electric battery vehicles, and arrangements had been made for the production of as many of these vehicles as were likely to be required for essential work. Facilities had also been given to designers to produce prototypes of new models which appeared to be improvements on those which existed.

Asked by Mr. Thorne whether the vehicles cost more to build than petrol-driven ones, Mr. Noel Baker stated that they cost a little more to build but they were cheaper to operate.

Jet Propulsion

While the immediate importance of jet propulsion is in relation to aircraft, the application of the principle is of much wider significance. The outstanding achievement, it is pointed out in *Flight*, is the development of a small light continuous-combustion gas turbine as a practical alternative to the reciprocating engine. An essential component is the compressor into which air is drawn, compressed, heated in combustion chambers by the injection of fuel, partly expanded in the turbine wheel which drives the compressor and expelled through an exhaust pipe to provide the propelling thrust by reaction.

During 1933, the B.T.H. Co. had investigated the possibilities of various gas-turbine cycles as a means for generating power and had previously constructed plant for high-temperatures—notably the 10,000-kW steam turbo-alternator supplied to the Detroit Edison Co. for operating with an initial steam temperature of 1,000 deg. F. Added to this was a lengthy experience in the building of high-speed turbines and compressors and the possession of data regarding materials suitable for withstanding very high stresses.

When approached in January, 1936, by Group-Capt. Whittle (to whom the B.T.H. Co

had supplied information in 1931 regarding turbo-compressors and super-chargers for a paper he prepared for the Royal Aeronautical Society), the company agreed to collaborate with him in the design and manufacture of a jet-propulsion engine and the first unit was run on test within fifteen months. After extensive modification in design, a plane propelled by the engines was successfully flown in May, 1941. A similar engine was sent to the General Electric Co. of New York in September 1941.

Commodity Insurance Scheme

The Board of Trade announces that the rate of premium payable under any policy under the Commodity Insurance Scheme is to remain at the rate of 5s. per cent. (or 1s. 8d. per cent. per month) for the period beginning March 3rd and ending June 2nd, 1944.

Instrument-Making School

The Northampton Polytechnic, St. John Street, London, E.C.1, announces that the Junior Technical School for instrument making and horology has been transferred to Fishpool Street, St. Albans, Herts, where classes are being conducted in a course of three years' duration (secondary education of a practical type). Applicants must pass an entrance examination to be held on March 13th both at St. Albans and the Polytechnic, forms of application being obtainable from the latter.

P.V.C. Cable Data

Technical data relating to cables and flexible cords of the p.v.c. type, which are insulated or sheathed with polyvinyl chloride, are contained in descriptive list (NSC.11) issued by British Insulated Cables, Ltd., Prescot, Lancs. Since the text was prepared the field of application of cables of this kind has been extended to ships and there have been developments in methods of repairing and jointing these synthetic coverings. Further issues of the leaflet will be extended to include more comprehensive information on these aspects of the subject.

Electrical Apprenticeship

In the February *Electrical Supervisor* particulars are given of a revised scheme of apprenticeship for electrical installation and maintenance work, prepared by the Council of the Association of Supervising Electrical Engineers. Indentures of apprenticeship would be made between parents and employers. A period of four years is envisaged, the apprentices being not less than fifteen years of age at the commencement. Certain standards of education and physical fitness would be required and there would be a maximum probationary period of three months.

Suggested schedules of training provide for given periods in the stores, in workshop, drawing office, estimating and installation practice, and assembly and erection of equipment, according to the branch entered. After four years the apprentice would become a "young journeyman" for a period of not more than twelve months.

Adequate facilities for technical education would be provided at no expense to the apprentice, leave being granted for the purpose by the employer, and grants would be made to apprentices on attendance and progress at work and at school.

The scheme would be administered by a Central Apprenticeship Board composed of representatives of the various interests affected such as the A.S.E.E., B.E.A.M.A., the C.M.A., the E.C.A. and the E.C.A. of Scotland, the E.T.U. and E.L.M.A. It would be operated through local committees, and maintain a register of apprentices and applicants for entry and regulate the supply according to the industry's needs. The necessary funds would be provided by the organisations represented and/or by State grants.

Fan Manufacturers' Association

The Fan Manufacturers' Association, Ltd., was registered on February 12th as a company limited by guarantee without share capital. The original number of members is not to exceed 50, each liable for one guinea in the event of winding up. The objects are to promote the status and interests of producers of industrial fans, to assist the fan engineering industry by providing a central organisation, to develop scientific and economical methods, to standardise engineering practice in respect of tests and ratings of fan equipment, etc. The first directors are J. W. Gibson, Overdales, Great Warley, Essex (Davidson & Co. Ltd., Belfast); G. R. Thursfield, 30, Cheyne Walk, S.W.3 (Sturtevant Engineering Co., Ltd.); and G. L. Copping, Brookslee, Brookshill Drive, Harrow Weald, Middlesex (Blackman Export Co., Ltd.). The registered offices are at 23, Queen Square, London, W.C.1.

Nurses at Power Station

In 1941 Fulham Borough Council, as a wartime measure, approved the appointment of nurses to serve at the power station. There are now four nurses, who are responsible for the first-aid post, for dealing with all accidents, for the general health services, and for general safety measures as regards the women employees. Recently the Establishment Committee has had under consideration a report by the borough electrical engineer on their pay and status, in which the opinion is expressed that they should be properly graded and classed as officers. The Committee recommends that the nurses shall be classed as temporary officers with a salary scale of £190–230, three to be placed on the scale at £200, and the fourth, who is not State registered, at £195.

Electrical Commercial Travellers

The important part commercial travellers will have to play in the electrical industry after the war was emphasised at the annual luncheon of the Electrical Trades Commercial Travellers' Association at the Connaught Rooms, London, W.C.2, on Friday. Proposing the toast of the Association, Mr. R. W. Hughman declared that commercial travellers were the spearhead troops of the electrical industry. They were acting for a scientific industry and must have technical knowledge. Training was essential and he would like to see established a college of supersalesmanship. When peace came the electrical field would be stupendous. In the first five years after the war it would, for instance, be necessary to put down 4 million kW of generating plant.

In reply, the president, Mr. A. G. Beaver,

mentioned that of the 250 members 60 per cent. represented manufacturers and 40 per cent. wholesalers and he appealed for a greater membership from the wholesaling trade. In making his appeal for contributions to the Benevolent Fund, Mr. S. Johnson, the hon. secretary, mentioned not only the help it gave its own members, but also the contributions made to the E.I.B.A., the Commercial Travellers' Benevolent Institution, and the Commercial Travellers' School. Other speakers were Messrs. W. F. Moir, A. J. Dew and J. G. Edwards. Mr. F. W. Wheatley took the chair.

Fire at Brown-Coal Mine

The disastrous bush fires which occurred in Australia last week, causing the death of twelve persons and destroying thousands of cattle and many houses, also resulted in extensive damage at the Yallourn brown-coal mine. The Melbourne Correspondent of *The Times* states that one of the worst fires was in an open cut measuring three miles by five at the Yallourn mine, which is operated by the State Electricity Commission for the generation of electric power for a large part of Victoria. The fire is reported to have extended for a distance of a mile and to a depth of 200 ft. By February 16th, the third day, half the fire had been extinguished and it was expected to be completely out by the end of the week. The generation of electricity at Yallourn will be reduced by two-thirds for some time, it is stated. In Melbourne supplies have been cut by 40 per cent., and on alternate days industrial power (except for essential industries) is being withheld in the two sections into which the area has been divided. Suburban train and tram services have been curtailed, and there is a ban on domestic electricity consumption from early morning until evening.

Insulating Plastics

It was recently reported that the share capital of Hammans Industries, Ltd., and associated companies, had been acquired by De La Rue Plastics, Ltd. It has now been announced that a new company has been formed, De La Rue Insulation, Ltd., which will absorb the laminated division of De La Rue Plastics, Ltd., Hammans Industries, Ltd., and its associated companies, and will manufacture and distribute the companies' products, including "Delaron" laminated plastic, "Delarex" constructional board, "Hamolac" insulating sleevings and "Hamofil" connecting wires.

The new company commences trading on February 28th. The sale offices will be at Brighton Road, Sutton, Surrey, with showrooms at "Imperial House," Regent Street, W.1.

Power Condensers

An illustrated technical brochure of 44 pages issued by the Bryce Electric Construction Co., Ltd., Kelvin Works, Hackbridge, Surrey, describes the materials used for and method of constructing static condensers for correcting poor power factor. They are made under licence from the Swiss originators and sizes up to 400 kVAr and 11,000 V have been installed, the design being suitable for outdoor types up to 1,000 kVAr and 33 kV. The "plates" consist of aluminium foil with fine tissue "paper" dielectric prepared from pure linen rag, the standard elements of 16 μF at 400 V being assembled in banks within oil tanks. In addition to specification and test summaries the brochure explains why power factor should be improved and includes tabulated data for calculating the size of condensers to employ with advice on type selection and choice of associated switchgear.

Copper for Fuses

Further relaxation of the restrictions on the use of copper in electrical equipment in the United States is reported in the *Electrical World*. Copper and copper-base alloy may now be employed in renewable electric fuses and electrical wiring devices. Steel had been prescribed for these products under Orders L.161 and L.277 issued by the War Production Board, which have now been amended. The changes have been made because of the additional machine time required to work steel, the difficulty of obtaining steel rod, and corrosion of steel wiring devices after short use. In the case of non-renewable fuses the restrictions on the use of copper remain in force.

Boiler Operation

Two new posters have been produced by the Ministry of Fuel and Power, one on "Single-Pass Economic Boilers" and the other on "The Lancashire Boiler." Copies are obtainable from the Ministry at 7, Millbank, S.W.1.

Materials Catalogue

A résumé of the various Government controls affecting the supply of electrical materials is included at the end of the general catalogue, priced and liberally illustrated, just issued by the London Electrical Co., Ltd., Blackfriars Road, London, S.E.1, wholesalers of installation materials and accessories, lighting equipment, switchgear, instruments and tools.

Joints in Conduit

In the summary of the E.R.A. report on the electrical resistance of conduits published in our issue of January 28th (p. 118) the term "megohms" was inadvertently employed instead of "milliohms" in referring to the measurement of resistance.

American Building Methods

Pre-fabricated houses, which take only a day to erect complete with connections for water, electricity and drainage, are referred to in a report of a British Building Mission which has been studying building methods in America ("Methods of Building in the U.S.A.," H.M. Stationery Office, price 4d.). With regard to the provisions made for using electrical appliances designed to reduce the housewife's labour, it is mentioned that a number of plug sockets is provided in every room. A refrigerator is regarded as a necessity in most kitchens, largely, however, because the roomy, well-ventilated type of larder common in this country is far less general in the United States.

In larger buildings the Mission was impressed with the spaciousness and economy of planning which were made possible by developments in the technique of artificial lighting. This development is accompanied by a tendency to give less importance to daylighting conditions

than is customary in this country. It is considered that the British climate does not call for mechanical ventilation and air conditioning in the majority of buildings, but these systems would be useful in helping to exclude street noises in central city districts, and would be required in buildings such as art galleries, museums, etc., where greater reliance is placed on artificial lighting.

Attention is drawn to the use of waste steam from generating stations to heat large buildings such as offices and hotels. In the U.S.A. a building is fully designed before the work is put out to tender, and drawings for the structural frame and for the heating, lighting, plumbing, etc., are prepared by professional experts. Welding is occasionally used in structural steel frames, though all-welded structures are still uncommon. The use of small hand power tools is much more widespread among all trades, especially carpentry, than in Great Britain, and the Mission considers that it is largely owing to these tools that the American building craftsman is able to develop his full earning power. To make this possible ample supplies of cheap power at a suitable voltage are essential.

Supply Workers' Wage Claims

The J.I.C. for the London District has rejected a claim by shift workers at the Barking station of the County of London Electric Supply Co. for double time for Sundays and time and a half for night work.

Since January 24th, while the dispute has been in progress, the shift workers have been operating a six-day shift rota, claiming Sundays as their rest day, as against the old seven-week rota which gave them one Sunday in seven. In order to ensure the continuance of output for the wide area supplied from the station, the men on the Saturday afternoon, 2 p.m. to 10 p.m., shift have continued and completed 32 hours' work on end.

A wage claim submitted by the trade union side of the No. 1 District Council (North-East Coast) for the Electricity Supply Industry, has been rejected by the Industrial Court. The Council proposed that all grades of workers in the district (except switchboard and substation attendants, their assistants and apprentices) should be granted an increase of 1½d. an hour on the present basic rates. The Court decided that the claim had not been established.

Society of Electric Accumulator Manufacturers

We have received particulars of a society which has been formed with the above title, membership being open to those engaged in the manufacture of secondary batteries. Its primary object is stated to be to provide permanent facilities for joint consideration by the accumulator manufacturers of the various problems which affect their interests and to promote co-operation and goodwill between all engaged in the industry. Collaboration through the Society will be possible in matters of a character such as technical research, the establishment of labour and manufacturing standards, the utilisation of manufacturing capacity, the maintenance of fair trading conditions and new ideas among the manufacturers of kindred products. The Society will also form a channel through which the industry can be consulted by Government Departments and others on all matters where the guidance of accumulator manufacturers as a body is sought. The activities of the Society will be controlled by a council of which Mr. Edmund Hickey, of Trojan Accumulators, has been elected the first chairman. Inquiries should be addressed to the secretaries at York Mansion, 94/98, Petty France, Westminster, S.W.1.

"Back at Work" Exhibition

To demonstrate how disabled and blind men and women, after scientific treatment and specialist training, are enabled to play their part in skilled employment, a "Back at Work" Exhibition was opened jointly by the Ministries of Labour and Information on Wednesday, at the Royal Academy, Picadilly, London, and will continue until March 14th. Forty-two men and two women are taking part; sixteen are blind and the disabilities of the remaining twenty-eight are of various kinds, including leg and arm amputations. Most of the training shown in the exhibition is given by the Ministry of Labour under its Interim Scheme. The Ministry has its own centres and it also uses technical colleges. This is of necessity a temporary wartime expedient and concentrates on war employment, but plans are now being worked out to provide for the expansion of the scheme to meet post-war needs.

Thermoplastic Cables

In his contribution to the I.E.E. Installations Section discussion dealt with in our last issue Mr. J. Veit (Duratube & Wire, Ltd.) referred to a possible revolution in the manufacture of high-voltage cable owing to the use of polythene. The last word was inadvertently reported as "polystyrene."

Grants to Transferred Workers

A leaflet (PL/EDL.59) issued by the Ministry of Labour & National Service sets out the grants and allowances available to workers who are transferred to employment of national importance beynod daily distance from their homes.

Institution of Factory Managers

The March meeting of the Institution of Factory Managers, South Eastern (London) Branch, will take place at the Bonnington Hotel, Southampton Row, W.C.1, on Saturday, March 25th, at 2.45 p.m.

TRADE MARK APPLICATIONS

RECENT applications for British trade marks include the following, objections against which may be entered within one month from February 16th:—

MANCOLOY.—No. 624,678, Class 6. Alloys of manganese, copper and nickel in wire, strip or other form for use in the manufacture of electrical apparatus or component parts.—Mallory, Metallurgical Products, Ltd., 78, Hatton Garden, London, E.C.1. To be associated with No. 624,677 (3434) ix.

Motor Faults

Breakdowns that Could be Averted by Skilled Attention

By J. P. Crossley

BROADLY speaking, faults on AC motors may be divided into three groups, namely, those which occur (1) before the machines leave the manufacturers' works; (2) when they are first put into service; and (3) after they have been in service for some time.

Taking the first of these groups, it will be sufficient to say that faults in design and/or construction are, in these days, extremely rare, as all the leading manufacturers have by now accumulated comprehensive details of the performance of their own machines of every standard frame size over a considerable number of years. Sometimes machines of quite satisfactory design are badly wound or assembled, but these cases are usually discovered on the test bed and rectified.

Choice of Correct Machine

The second group is principally due to wrong application to load or faulty installation. One standard type of motor cannot be employed for all purposes because the required performances are so greatly varied, as also are the conditions under which the machines have to work. The right type of motor must be chosen in each individual case. A motor may be started only once or twice a day, as when driving a line shaft feeding several machines which are individually controlled by mechanical devices, *i.e.* fast-and-loose pulleys or clutches; then again a motor may be required to start and stop, sometimes with reversal of rotation, several times an hour, as for lift and crane duties.

Open-type motors should not be used in damp, dusty or dirty places, but only where they are amply protected from accidental access and are in clean, dry atmospheres. Enclosed-ventilated or protected motors are suitable for the majority of indoor places where the atmosphere is reasonably clean and dry. Drip-proof, pipe-ventilated, or totally enclosed motors should be used where they are exposed to falling water, or in very wet, dusty, or dirty places such as laundries, sawmills or cement works. Special conditions require special constructions, such as watertight frames for submersible pump motors, and gas- and flame-proof frames for gas works and coal mines.

Where a motor can be started against a light load, a squirrel-cage motor may be employed and either a star-delta starter or an auto-transformer starter will be sufficient to keep the starting current within the supply authority's limitations, except in places where the mains are inadequate and special restrictions are imposed. Squirrel-cage motors can be designed to start against moderate loads by the use of high resistance rings on the rotor, though this method reduces the efficiency and increases the slip. They are sometimes used on cranes and where efficiency is not of great importance. When a motor has to start against a heavy load a slip-ring motor or a commutator type should be used. They can be designed to start against full-load torque with little more than full-load current and against three or four times full-load torque with a corresponding increase in current.

It is advisable when ordering a motor to give the manufacturer all available information about the purpose for which it is required and care must also be exercised when ordering the starter from a different source to give all the motor particulars. This is especially so in the case of slip-ring motors, when it is essential to describe the rotor connection, open-circuit voltage between the slip-rings, rotor current, whether the slip-rings are all insulated from the shaft, whether fitted with brush-lifting and short-circuiting devices, in addition to stating the purpose for which the motor and starter are required.

Insulation Breakdown

In the third group, let us first deal with breakdown of insulation, which is usually caused by dirt, damp, overheating, vibration, abrasion or ill-usage. Where the position of a permanent fault to earth is not revealed by inspection, it is easily located by passing a small current from one terminal through the fault and tracing the current along successive conductors by means of a millivoltmeter until a conductor is found in which no current is flowing; the fault lies between this and the last in which current was flowing.

When a breakdown of insulation causing a short-circuit occurs between turns in only one coil, it is usually easily located, because the induced current in that coil is so great that it is burned out in a very short time and a rewind is inevitable. Where, however, the short circuit occurs over several coils, as it may when the "short" lies between the interconnections, it can sometimes be located in time to save the windings and repair the fault.

An open-circuit caused by a broken conductor can be located by means of a lighting-out set, though a distinction must be made between star and delta connections. With a star winding there will be no circuit between the terminal of the defective phase and the other two terminals, *i.e.* if the terminals are

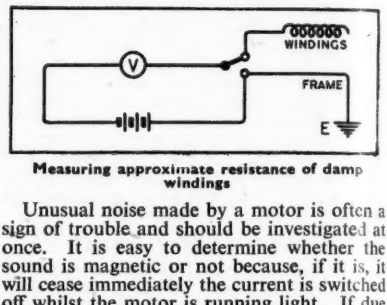
A, B and C, and the break is in A phase, then there will be no circuit between either A and B or A and C, but there will be a circuit between B and C. This is at once apparent on using the lighting-out set. The next step is to explore the successive coils in the defective phase until the position of the open-circuit is ascertained. In the case of a delta winding with a break in one phase there will still be a circuit between all three terminals; the defective phase should, therefore, first be located by means of a comparative resistance test. If there is a break in the phase across A and B then the resistance will be twice as great as between either A and C or B and C, and the next step will be to disconnect the ends of the defective phase and then explore the successive coils until the position of the break is located. Partial open-circuits and high resistance caused by bad joints can be located by means of a millivoltmeter, higher readings denoting bad joints.

Effects of Dampness

Sometimes after a motor has been standing idle for a considerable time the insulation resistance becomes low, without showing any localised fault, due to dampness. When a motor is obviously very damp it may not be safe to apply a "Megger" owing to the danger of puncturing the insulation. The resistance should then be measured approximately by means of an accumulator and voltmeter, the negative connection being made to the frame of the motor under test, the positive connection to the voltmeter and the negative terminals of the voltmeter to a two-way switch by which it can be connected either to the windings under test or the negative of the accumulator. The insulation, R_1, then $= \frac{R_v(V-v)}{v}$ in ohms. Where R_v is the resistance of the voltmeter, V is the voltage of the battery and v is the voltmeter reading when connected to the winding. When this test shows a reading above 10,000 ohms it can be assumed that it is safe to apply a "Megger" to obtain a more accurate measurement.

The most satisfactory method of drying out such cases is to heat the motor in an oven, maintaining the temperature at 200 deg. F. for several hours, sometimes days, until a satisfactorily constant I R reading is obtained. After a further six or eight hours' stoving the windings should be treated with a waterproof varnish. It may not always be possible to put the machine in an oven and a good method is to pass low-voltage current through the windings to heat them, taking care that no part of the windings becomes so hot as to damage the insulation, and where possible the motor should be covered to exclude draughts and only a little air allowed to pass through to carry away the moisture.

On a motor showing signs of overheating whilst in service, the first check is to test the applied voltage at the motor terminals and measure the current in each phase whilst on load, as perhaps the most frequent cause of motor trouble is single-phasing due to a faulty contact in one line, with consequent overloading of the windings across the other lines. If the voltage and current in each phase are balanced and the motor is not overloaded, then the trouble may be caused by the air ducts having become choked with dust, thus affecting the ventilation of the motor and making it necessary to dismantle it and thoroughly clean out all the ducts.



Measuring approximate resistance of damp windings

Unusual noise made by a motor is often a sign of trouble and should be investigated at once. It is easy to determine whether the sound is magnetic or not because, if it is, it will cease immediately the current is switched off whilst the motor is running light. If due to mechanical or pneumatic causes, it will subside only with the motor speed.

The causes of most mechanical noises are usually obvious, but a magnetic source of noise may be more obscure, calling for the services of an experienced engineer to locate it. Sometimes an open-circuit in a rotor winding may cause a distinct grunt having the frequency of the slip.

Lubrication of motor bearings is of great importance. Over-lubrication often results in surplus lubricants penetrating the windings and causing breakdown of insulation.

Control Gear Faults

The most frequent troubles on control gear are due to loose or broken connections, burnt or worn contacts, and burned out no-volt coils due to sticking plungers.

In conclusion, prevention is better than cure, and many faults can be avoided by regular, careful maintenance involving real inspection and cleaning. Install the correct motor and control gear for your job; remember that fuses are intended to protect the wiring, not the motor; keep everything clean and connections tight; replace fuses that show signs of overheating; see that the bearings are correctly lubricated; where brushes are used keep them well bedded and of ample length; and check the operation of no-volt and overload devices by actual operation once a month. Always make certain that the supply is switched off and test by shorting and connecting to earth before cleaning or inspecting the switchgear or motors.

ELECTRICITY SUPPLY

Cardiff's Post-War Plan. Dundee Experiment.

Bedford.—DAMAGED LAMP STANDARDS.—Reporting on the reinstatement of public lighting, the street lighting engineer says that a number of cast-iron lamp standards in the borough have been damaged by vehicles during the last two years and it has not been possible in all cases to replace the damaged standards and fittings owing to shortage of materials. After the war, the principal streets will undoubtedly have to be equipped with improved lighting and to do that effectively the lamp standards should be made of steel or concrete, with posts suitable to allow of a mounting height for the lantern of 25 ft. above ground. It is proposed that in future the standards which are damaged shall be replaced by new ones suitable for improved lighting, the existing short standards from the main thoroughfares being used in side streets.

Cardiff.—POST-WAR RECONSTRUCTION.—Plans approved by the Electricity Committee for post-war development and reconstruction include the resumption of the sales section and load development; interconnection of the 33 and 6·6 kV systems; extension of Roath power station; extensions to offices; substations in the trolley-bus system; supervisory control of major substations; completion of DC change-over; standardisation of distribution voltage; resumption of meter certification; development of supply in Penarth; mains development to new housing estates, and street lighting conversion.

CONDENSATION AT BATHS.—In order to reduce condensation in the cubicles at the Dock baths the Health Committee has arranged for the Electricity Department to install electric heaters at a cost of £40.

Dorchester.—METER READING PROBLEM.—At a meeting of the Electricity Committee it was reported that the woman meter reader had left and as efforts to obtain a trainee for the vacancy had failed it might be necessary to extend periods between readings in some areas. The electrical engineer was asked to endeavour to secure aid so that readings could continue to be made quarterly.

STREET LIGHTING.—The Highways Committee has decided in favour of a scheme for modified street lighting.

Dundee.—GAS OR ELECTRICITY?—Recently, when the convener of the Gas Committee suggested that Corporation houses should be supplied with gas equipment for heating water, Bailie Baird, convener of the Electricity Committee, protested that the tenants should be allowed to choose. It is now reported that the Corporation Housing Sub-Committee, as an experiment, is to install electricity in 24 houses and gas in a similar number which are being built in order to find out from the tenants which service is most popular for future developments.

Exeter.—RATE CONTRIBUTION.—The Electricity Committee has decided upon a contribution of not more than £1,800 to the rate fund.

London.—SOOT-BLOWING EXPERIMENTS.—Last May Fulham Electricity Committee arranged for experiments to be carried out in connection with the installation of automatic soot-blowing plant and the Stirling Boiler Co., Ltd., offered to install plant of the company's design on five boilers at its own cost, leaving the question of payment, if any, to be settled when the plant had been thoroughly tested. The borough electrical engineer now reports that the plant is entirely satisfactory and the Committee accordingly recommends that the company shall be paid £4,500.

OVERSPEED PREVENTION.—The borough electrical engineer of Fulham has reported that the existing overspeed prevention equipment on the turbines is not entirely satisfactory, and that it is desirable that two wattmeter relays should be incorporated with the existing equipment to work in conjunction with the pressure relay. The Electricity and Lighting Committee has recommended that the quotation of the Metropolitan-Vickers Electrical Co., Ltd., shall be accepted and that an expenditure of £2,000 shall be authorised, including the cost of certain civil engineering and electrical work to be carried out by the Council.

Newbury.—STREET LIGHTING PREPARATIONS.—The Highways Committee has received a provisional scheme for electric street lighting from the Wessex Electricity Co., and the borough engineer states that there is no doubt that immediately after the war there will be a demand for street lighting and that plans should be made before next winter. The Committee has decided to invite the Gas Department and the electricity company to submit schemes for public street lighting with details of capital and maintenance charges.

Nottingham.—UNDERTAKING'S JUBILEE.—The Nottingham Corporation electricity undertaking will celebrate its jubilee on September 18th this year.

Stalybridge.—FARM ELECTRIFICATION.—The Stalybridge, Hyde, Mossley and Dukinfield Joint Transport and Electricity Board has been informed by its engineer, Mr. J. H. Lumsden, that the development of the farm electricity load has been encouragingly satisfactory. In order to cheapen the installation costs, he has been authorised to offer new charges to a few farms for further experimental experience.

Swansea.—ELECTRICAL REPAIRS.—The Education Committee has asked the borough electrical engineer to carry out in future all electrical repairs needed in the schools and institutions.

DISTRIBUTION IMPROVEMENTS.—The Electricity Committee is to proceed with a scheme for various improvements of the distribution system. Additional supplies are to be given to the Swansea Steel Products Co., at the Morriston works.

Whitby.—COUNCIL'S POLICY.—The Urban District Council has received a letter from the Whitby Rural District Council asking for certain information regarding the electricity undertaking, including electricity charges. The U.D.C. has replied that it has always been the policy of the authority to consider electricity

profits in relation to charges. During the 43 years of the undertaking's existence it has made a loss of £22,000 because of the Council's policy that consumers should have cheap electricity. The Council also contends that its charges to neighbouring villages are lower than those of Scarborough Corporation and the North-Eastern Electric Supply Co., Ltd. The Rural District Council has accepted the U.D.C.'s letter as satisfactory.

Overseas

Eire.—VILLAGE'S FREE LIGHTING.—Our Dublin correspondent writes :—Rathwire, a village adjoining Killucan in co. Westmeath, is being supplied with free light by the Killucan House of the Camillian religious community, a nursing order which came to Westmeath in 1935. One of its members, the Rev. Br. Etienne Desbois, a Frenchman, discovered on his arrival a dilapidated dynamo and turbine which had formerly been to drive a corn mill. He put them in working order and to begin with obtained sufficient electricity for the community. Next he changed the turbine vertical drive (with shaft and crown wheel) to a horizontal one (with pulley and belt) and reduced the tunnel at the head of the turbine to the level of the river bed. The result was that where previously only surface water accumulated by damming was available, the full flow of the river is now in use for generating purposes. Flooded low-lying lands have been relieved and 50 houses are now electrically lighted.

India.—IRRIGATION PROJECT.—Supplementary to the proposals to extend irrigation schemes to the utmost it is reported that the Bihar Government has prepared a scheme to improve the irrigation of Southern Bihar by tube-wells, which will obtain their motive power from a 33-kV line from Patna to Bihar Shariff, and from Bihar Shariff to Ekangar Sarai. The power will be generated at Patna and distributed over subsidiary 11-kV lines. Besides assisting irrigation of rabi growing areas the line will be a component part of the electric grid system, states *Indian Engineering*.

Germany.—FUEL CONTROLLERS.—The *Kieler Zeitung* announces that the Mayor of Kiel has decided to appoint fuel controllers to watch domestic electricity consumption. The paper states that since the autumn consumption has rapidly increased, economy publicity being ignored. Severe action is to follow.

Even hotels have their special power controller in Germany. He is Dr. Hilland, who has the impressive title of Commissioner for the Saving of Power in Tourist Traffic. From the beginning of the year all guests have had to sign a statement promising not to use small electrical appliances such as hair dryers and curlers.

New Zealand.—"RATION" EXCEEDED.—In his annual report for 1942-43, Mr. L. B. Hutton, general manager, Wellington, says that the period was marked by the shortage of electricity that developed in the North Island. The city's ration for the year was fixed at 2½ per cent. above the corresponding weekly consumption in the previous year, but despite every endeavour the amount was exceeded. Mr. Hutton points out that it is one thing for the bulk supplier (the Government) to impose a ration on its customers (the supply authorities), but quite a different matter for the latter to ration consumers. One measure of curtailment most acceptable was a Government prohibition of the use of radiators for domestic purposes between 4 and 6 p.m. from May to September.

Altogether 135·6 million kWh was sold during the year, compared with 128·9 million kWh in 1941-42. The maximum demand rose from 35,312 to 36,488 kW and the load factor improved from 45·8 to 46·6 per cent. There was a decrease from 0·82d. to 0·81d. in the average revenue per kWh sold. The revenue rose by £13,840 to £464,479, while working expenses were £7,391 less at £336,767. Capital charges and special expenditure, however, required £36,204 more than in the previous year and the credit balance dropped from £24,286 to £9,313.

TRANSPORT

Liverpool. — TRANSPORT PROFITS. — The accounts of the Corporation Passenger Transport Department for the year to March 31st give promise of a surplus of £308,100 from the trams and motor-buses, the figure for the trams being £257,800. For the year 1944-45, the trams are expected to yield a surplus of £308,100, and the motor-buses £39,700. From the current year's assets, it is proposed to transfer £230,000 to the reserve, renewal and depreciation fund.

Fair Trading

Report for the Past Year

ELECTRICAL retail business has been very severely reduced during the past four years and consequently the Electrical Fair Trading Council has not been so active as in peacetime. Nevertheless, the principles of fair trading have been sustained by the member associations so far as has been possible.

The report for 1942-43, presented at the annual meeting on February 4th, gave particulars of three outstanding matters which were before the Council during the year. The first related to the Goods and Services (Price Control) Order as it affects electrical appliances. Negotiations have been conducted with representatives of the Central Price Regulation Committee who were fully advised, through a small *ad hoc* committee of the Council, of the electrical industry's views generally on this matter.

The Council has been informed of the action taken by a committee of heating, cooking and domestic appliances makers of B.E.A.M.A., with the assistance of the N.E.C.T.A., Ltd., to combat the menace of unsafe appliances of inferior design and workmanship offered for sale to the public, and it is hoped that their efforts in this direction will be continued with success.

In connection with the discount schedules, urns, previously placed in Categories 1 and 4 of Schedule 5, have now been transferred entirely to Category 3, making the approved "standard" discount for urns of all sizes 15 per cent. (subject to quantity terms).

A new schedule for electric clocks has been prepared for inclusion in the next edition of the Fair Trading Policy, in collaboration with the British Synchronous Clock Conference. Further schedules are in prospect for domestic electric refrigerators and control gear for discharge lighting.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The English Electric Co., Ltd., reports that the balance of trading profit for the year ended December 31st last, after providing for taxation and including the dividend receivable from D. Napier & Son, Ltd., was £570 582 as compared with £559,370 for 1942. The net profit, after making provision for depreciation (again £100,000), debenture interest, etc., was £419,346 (£407,560) to which is added £53,030 brought forward. From this the preference dividend is paid and the ordinary dividend (as already announced) is maintained at 10 per cent. The allocation to general reserve is again £100,000 and a balance of £62,631 is carried forward. The liquid assets of the company, *i.e.* excess of cash, stocks, work in progress and debtors over creditors, amounted at December 31st to £2,987,603.

The report says that during the year the company acquired the balance of the ordinary shares of D. Napier & Son, Ltd.

The London Passenger Transport Board announces that its net revenue for 1943 amounted to £4,747,280, after giving effect to the estimated proportion of the financial arrangements provided for in the Railway Control Agreement, and including the profit on the realisation of an investment, the balance of the London Transport "C" stock interest fund and a sum of £57,482 arising from an adjustment of the Board's estimated proportion of the Railway Control Pool for 1940. The net revenue in 1942 was £4,840,705, receipts from other sources bringing the total to £4,882,917. Interest on the prior charge stocks takes £3,901,381 (£4,080,447) leaving £845,899 (£802,470). A final payment of 2 per cent. actual (1½ per cent.) is to be made on the "C" stock, making 3½ per cent. (3 per cent.). It is pointed out that the increase of 1½ per cent. is due to the exceptional payment to the Board relating to the year 1940 already referred to.

Mather & Platt, Ltd., state that their net profit for 1943 was £168,388, as compared with £171,545 for 1942. The final ordinary dividend is 6 per cent. maintaining the distribution at 10 per cent. (For 1942 there was a special distribution of 1 per cent. free of tax from special reserve.) The balance carried forward is raised from £87,736 to £99,758.

Lancashire Dynamo & Crypto, Ltd., has allotted 2,160 of the 200,000 £1 ordinary shares created following a meeting of shareholders on March 31st last, as part of the purchase consideration of 7,501 £1 ordinary shares in the Nevelin Electrical Co., Ltd.

The Birmingham & District Investment Trust, Ltd., which is controlled by the British Electric Traction Co., Ltd., records an investment income for 1943 amounting to £255,635, compared with £250,903 for 1942, and traffic receipts totalling £124,206 (£119,411). Adding various toher items the total revenue is £383,565 (£372,032). After providing for expenses, debenture interest, and £163,000 (£179,771) for tax provision, the net profit is £182,553 (£154,387). A final ordinary dividend of 5½ per cent. is to be paid, making 8½ per cent. (same) and after again allocating £20,000 for reserve against investments, there remains £89,782 (£61,615) to be added to undivided profits account.

Clarke, Chapman & Co., Ltd.—The gross profit for 1943 was £122,448, against £122,239 for the preceding year; the net profit declined slightly from £98,605 to £96,038. The staff pensions reserve receives £10,000 (same) and £20,000 is again transferred to general reserve, making £240,000. The ordinary dividend of 12½ per cent. is repeated and £38,903 (against £37,038) is carried forward.

British Industrial Plastics, Ltd., reports a net profit of £21,659 for the year ended September 30th last (against £21,423). The trading profit rose from £295,799 to £327,852. General reserve receives £500 and the dividend on the ordinary shares is maintained at 8 per cent. The balance carried forward is £8,168 (against £6,698).

The County of London Electric Supply Co., Ltd., has declared a final ordinary dividend of 5 per cent., again making 8 per cent. for the year.

The City of London Electric Lighting Co., Ltd., announces that the ordinary dividend for 1943 will be 5½ per cent., and that it will be necessary to draw on reserves to pay part of it. For 1942 the dividend was 7 per cent.

The Mid-Southern Utility Co. is to pay final dividends of 2 49/80 per cent. on its "A" stock, making 5 9/40 per cent. (same); 1 69/80 per cent. on its "B" stock, making 3 29/40 per cent. (same); and 2½ per cent. on its "C" stock, making 5 per cent. (same).

The Northampton Electric Light & Power Co., Ltd., proposes to pay a final ordinary dividend of 6 per cent., making 10 per cent. for the year.

The Rushden & District Electric Supply Co., Ltd., is to pay a final dividend of 5 per cent., making 9 per cent. for the year.

The Clyde Valley Electrical Power Co. is again paying a final ordinary dividend of 5 per cent., making 8 per cent. for the year (same).

The Dublin United Transport Co. reports a revenue of £311,692 for 1943 (against £322,054), including £216,548 (£259,739) from the buses and £95,043 (£59,978) from the tramways. After meeting mortgage interest, etc., the profit was £279,711 (against £271,462). As already reported, the ordinary dividend is maintained at 6 per cent. and a balance of £66,612 is carried forward, as compared with £54,081 brought in.

New Companies

J. Dyson & Co. (1944), Ltd.—Private company. Registered February 14th. Capital £10,000. Objects: To acquire the business of manufacturers of, and dealers in, electrical and wireless equipment, formerly carried on by J. Dyson & Co., Ltd. (in liquidation) at Bradford. Directors: J. Dyson, Oak Trees, Moorland Crescent,

Menston-in-Wharfedale; C. J. Russam, 1089, Grangefield Avenue, Thornbury, Bradford; and S. E. Denham and Ada Denham, both of 27, Duchy Avenue, Bradford. Registered office: 111, Thornton Road, Bradford.

Household Industries, Ltd.—Private company. Registered February 9th. Capital, £2,000. Objects: To carry on the business of manufacturers of, and wholesale and retail dealers in, electrical and radio appliances, etc. Directors: J. E. Sexton, 22, Beaufort Drive, N.W.11; and R. Brosan, 245, Kilburn High Road, N.W.6. Registered office: Imperial House, 80/86, Regent Street, London, W.1.

Air Rectification, Ltd.—Private company. Registered February 14th. Capital, £100. Objects: To carry on the business of manufacturers of air conditioning plant and spare parts, electrical engineers, etc. Directors: A. B. Plevey and R. Mather, both of 30, Waterloo Road, Wolverhampton. Secretary: A. B. Plevey.

Adames Electrical Co., Ltd.—Private company. Registered February 14th. Capital, £500. Objects: To carry on the business of electrical and general engineers, etc. G. E. Adames, 1, Colville Mansions, W.11, is the first director. Registered office: 10, Coleman Street, London, E.C.2.

A. H. Venables, Ltd.—Private company. Registered January 29th. Capital, £2,000. Objects: To carry on the business of electrical, lighting, heating, telephone, radio, mechanical and general engineers, etc. Directors: A. H. Venables, 48, Beresford Crescent, Newcastle, Staffs; and L. C. M. Wesson, 56, Tarry Road, Birmingham, 8. Registered office: 48, Beresford Crescent, Newcastle, Staffs.

Companies' Returns

Statements of Capital

Ekram Electric, Ltd.—Capital, £1,000 in £1 shares. Return dated November 13th. 700 shares taken up. £700 paid. Mortgages and charges: Nil.

Stella Conduit Co., Ltd.—Capital, £20,000 in £1 shares. Return dated November 15th. All shares taken up. £20,000 considered as paid. Mortgages and charges: Nil.

Aron Electricity Meter, Ltd.—Capital, £350,000 in £151,936 stock and 198,064 shares of £1 each. Return dated November 26th. £151,936 stock taken up. £75,968 paid, plus £28,692 15s. premium. £75,968 considered as paid. Mortgages and charges: Nil.

Walsall Electrical Co., Ltd.—Capital, £7,500 in £1 shares (5,000 ordinary and 2,500 preference.) Return dated November 4th. 4,650 ordinary and 1,725 preference shares taken up. £6,375 paid. Mortgages and charges: Nil.

Simplex Conduits, Ltd.—Capital, £100,000 in £1 shares. Return dated November 15th. 90,000 shares taken up. £50,000 paid. £40,000 considered as paid. Mortgages and charges: Nil.

John Dugdill & Co., Ltd.—Capital, £10,000 in £1 shares. Return dated November 4th. All shares taken up. £3 paid. £9,997 considered as paid. Mortgages and charges: Nil.

Falconar Cross & Co., Ltd.—Capital, £7,000 in 3,500 preference and 3,500 ordinary shares of £1 each. Return dated November 3rd. 3,300 preference and 2,002 ordinary shares taken up. £2 paid. £5,300 considered as paid. Mortgages and charges: £3,839 14s. 9d.

Scattergood & Johnson, Ltd.—Capital, £10,000 in £1 shares (2,000 preference and 8,000 ordinary). Return dated October 18th (filed November 18th). 8,000 ordinary shares taken up. £1,252 paid. £6,748 considered as paid. Mortgages and charges: Nil.

Berkeley Electrical Engineering Co., Ltd.—Capital, £15,000 in £1 shares. Return dated September 21st. 14,500 shares taken up. £14,500 paid. Mortgages and charges: Nil.

Increases of Capital

John Hearson & Co., Ltd.—The nominal capital has been increased by the addition of £1,000 in £1 ordinary shares beyond the registered capital of £3,000.

Bridgend Relay Service, Ltd.—The nominal capital has been increased by the addition of £1,000 in £1 ordinary shares beyond the registered capital of £1,000.

Mortgages and Charges

Westool, Ltd.—Satisfaction in full on February 8th, 1943, of charge dated June 4th, 1941, and registered June 25th, 1941. (Notice filed February 10th, 1944.)

Winding-up Petition

Princely Battery Co., Ltd.—A petition for the winding-up of this company has been presented to the High Court by Max Stone, Ltd., a creditor, and will be heard on February 28th. Notice of intention to appear must be given to the petitioners' solicitors, Thornton, Lynne & Lawson, 240, High Holborn, W.C.1, by February 26th.

Bankruptcies

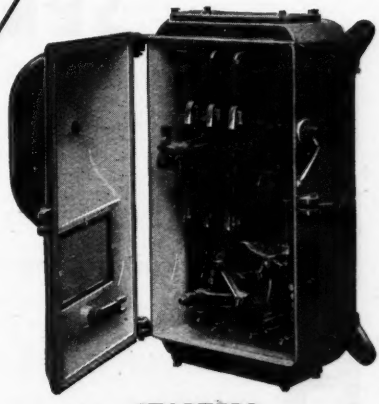
Edwards & Son, electrical dealers, 67, London Road, Brighton, Sussex.—The public examination was held recently at the Court House, Church Street, Brighton. The statement of affairs disclosed gross liabilities of £1,739, and the debtor, Mr. Horace Charles Casseldon, estimated that there was a surplus of assets over liabilities of £343. An interim dividend of 12s. in the £ had already been paid and on the debtor's behalf it was stated that a number of assets had been disposed of at a higher figure than the one estimated by the debtor and on that basis it was hoped to pay 20s. in the £ to the creditors.

T. P. Wood and **T. George,** trading in partnership as T. P. Wood, 28, Queen Street, Ipswich, electrical contractors.—Fourth and final dividend of 1s. 4½d. in the £ payable at the Official Receiver's Office, 13a, Great Coleman Street, Norwich.

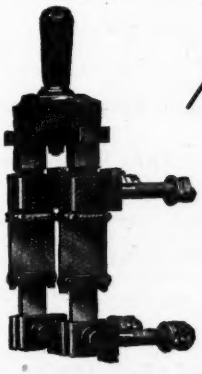
T. G. Helme, lately of Imperial House, 80-86, Regent Street, London, W.1, electrical equipment manufacturer (now in the Army).—Discharge suspended for two years and six months, until July 20th, 1946.

THE VERITY RANGE

MOTORS



STARTERS



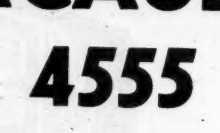
SWITCHGEAR

VERITYS LTD. ASTON, BIRMINGHAM 6

Sales Headquarters : BRETTENHAM HOUSE, LANCASTER PLACE, W.C.2

MACAULAY 4555

DAY OR NIGHT



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STOCKS AND SHARES

TUESDAY EVENING.

STOCK Exchange markets make a good showing on the whole. Exceptions there are, of course, but taking the following price-lists as fair criteria of the general tendency, it may be noticed that there are four falls, as against twenty-nine rises The strength of gilt-edged securities is reflected in an advance of 3 points in London Passenger Transport 4½ per cent. " A " stock. Industrial demand can be judged by the advances in General Electrics and similar shares. The speculative hand is seen in the renewed buoyancy of A. C. Cossor, E.M.I. and shares in other radio companies with promising post-war prospects.

Good Railway Dividends

The Home railway dividend season has produced unexpectedly good results from the Southern Railway and from the London Passenger Transport Board. The first dividend to be announced, the London, Midland & Scottish, was up to expectations ; the second, from the London & North Eastern, was accompanied by a statement that the net revenue had fallen, but the Southern Railway declared a dividend of 2 per cent. on its deferred stock (against 1¾ per cent. last year), surprising its own supporters. Southern stocks promptly improved and the preferred is 1¾ higher at 78 ex dividend. The London Passenger Transport Board has declared a dividend making 3¼ per cent. on the " C " stock, comparing with 3 per cent. a year ago. This brought in buyers whose operations raised the price to 66 ex dividend, at which the yield is £4 18s. 6d. per cent. Holders of the stock are looking to the future for their reward, and a possible 4 per cent. in the fairly near future is prophesied—perhaps a little optimistically.

Electricity Supply Shares

The City of London Electric Lighting Co. was expected to reduce its dividend, so the announcement of 5¼ per cent. for the year—against the previous 7 per cent.—caused a fall of no more than 6d. in the price of the shares, reducing it to 28s. Other London companies' shares are not affected. London Electrics have gained 6d. at 29s. 6d., the buying coming partly from the provinces. Northmets are similarly better at 39s. 6d. and County of London ordinary at 41s. 6d. are unchanged, the dividend of 5 per cent. again making 8 per cent. for the year. Clyde Valley and Northamptons repeat their previous dividend declarations.

In the provincial group, Midland Electric Power hardened to 44s. 6d. No change of consequence has taken place amongst the Overseas companies' shares. There has been a buyer in the market of 5,000 Calcutta Electric Supply preference at 24s. 3d.

Manufacturing and Equipment

Amongst the shares in industrial companies for which investment is to-day showing a marked partiality, those in the electrical manufacturing and equipment branch remain conspicuous. This will have been observed, no doubt, in the various rises which have occurred in prices during the past few weeks. No particular shares have been singled out, but inquiry still continues for the group as a whole. The floating supply of shares, never very large, has been greatly reduced.

General Electrics are up to 92s. and the company's 6½ per cent. preference at 34s. are 1s. to the good. Associated Electrical ordinary and preference have risen to 52s. and 39s. 6d. respectively. W. T. Henley's at 26s. 3d. show a gain of 9d. Murex are good at 102s. Automatic Telephones at £3 and Hall Telephones at 26s. have improved. Tube Investments are up to 97s. Veritys at 7s. 6d. and Vactrics at 13s. are each 3d. better.

Crompton Parkinson

Crompton Parkinson make a representative example of the type of industrial share towards which to-day's investment inquiries are directed. The price keeps steady at 28s. for the 5s. ordinary shares, which, on the basis of the last-paid dividend, gives a return of £4 0s. 4d. per cent. The dividend was raised to 22½ per cent. after being 20 per cent. per annum from 1939 to 1942 inclusive. Earnings on the ordinary shares for the last three years ranged from 36 to 38 per cent. Most of the ordinary capital is in " A " shares, of which there are 4½ millions. Of the ordinary shares there are 600,000 of 5s. each, the difference between these and the " A " shares being in the voting rights.

English Electric

The English Electric report for the year 1943 does not specify the sum allocated for taxation but, after providing for this, the net trading profit shows an increase of £11,200 as against that of the previous twelvemonth. The company has now, according to the annual report, acquired all the ordinary shares of D. Napier & Son. The English Electric dividend, as already announced, is maintained at 10 per cent., As before, £100,000 goes to depreciation and the balance forward of £62,600 is £9,500 up. The price of the shares, at 50s. 6d., is 1s. 9d. higher, allowing for deduction of the dividend.

Miscellaneous Matters

Animation has sprung up in radio shares. Cossors have been in the limelight and at 24s. 3d. are 1s. 3d. higher. Electric & Musical have hardened to 28s. 6d. Philco

(*Continued on page* 283)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend Previous	Dividend Last	Middle Price Feb. 22	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies					
Bournemouth and Poole	12½	12½	62/6	..	4 0 0
British Power and Light	6	7	33/–	..	4 4 10
City of London	7	5½	28/–	–6d.	3 18 7
Clyde Valley	8	8	42/–	..	3 16 0
County of London	8	8	41/6	..	3 17 0
Edmundsons:					
7% Pref.	7	7	34/–	..	4 2 4
Ord.	6	6	29/–	..	4 2 9
Elec.Dis.Yorkshire	9	9	45/–	..	4 0 0
Elec. Fin. and Securities	12½	12½	55/–	..	4 11 0
Elec. Supply Corporation	10	10	47/–	..	4 5 0
Isle of Thanet	Nil	Nil	18/–	..	—
Lancs. Light and Power	7½	7½	37/–	..	4 1 1
Llanelly Elec.	5½	6	25/–	..	4 16 0
Lond.Assoc.Electric	4	3	24/–	..	2 10 0
London Electric	6	6	29/6	+6d.	4 1 4
LondonPowerRed. Deb.	5	5	105½	+1	4 14 7
Metropolitan E.S.	8	8	42/–	..	3 16 0
Midland Counties	8	8	41/–	..	3 18 0
Mid. Elec. Power	9	9	44/6	+6d.	4 0 9
Newcastle Elec.	7	7	31/6	..	4 9 0
North Eastern Elec.:					
Ordinary	7	7	34/–	..	4 2 4
7% Pref.	7	7	35/–	..	4 0 0
Northampton	10	10	48/6	..	4 2 4
Notting Hill 6% Pref. (£10)	6	Nil	11	..	—
Northmet Power:					
Ordinary	7	7	39/6	+6d.	3 11 0
6% Pref.	6	6	30/6	..	3 18 8
Richmond Elec.	6	6	26/–	..	4 12 4
Scottish Power	8	8	40/6	..	3 19 0
Southern Areas	5	5	23/–	..	4 7 0
South London	7	7	27/–	..	5 3 8
West Devon	5	5	23/6	..	4 5 0
West Glos.	4½	3½	24/–	..	2 18 4
Yorkshire Elec.	8	8	43/–	..	3 14 5
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	6/–	+3d.	—
Calcutta Elec.	7*	6*	38/–	..	3 3 2
Cawnpore Elec.	10	10	35/–	..	5 14 3
East African Power	7	7	33/–	..	4 4 10
Jerusalem Elec.	7	5	28/6	..	3 10 2
Kalgoorlie (10/–)	5	5	10/–	..	5 0 0
Madras Elec.	4*	Nil	23/6	..	—
Montreal Power	1½	1½	23	..	6 10 5
Palestine Elec."A"	4*	5*	40/3	..	2 9 10
Perak Hydro-elec.	6	7	10/–	..	—
Shawinigan Power	83cts.	90cts.	17	..	—
Tokyo Elec. 6%	6	6	18	–1	—
VictoriaFallsPower	15	15	4¼	..	3 9 7
Whitehall Inv.Pref.	—	6	24/–	..	5 0 0

Company	Dividend Previous	Dividend Last	Middle Price Feb. 22	Rise or Fall	Yield p.c. £ s. d.
Public Boards					
Central Electricity:					
1955-60 Civil Defence)	—	2	100	..	3 0 0
1955-75	5	5	116	..	4 6 2
1051-73	4½	4½	107	..	4 4 1
1963-93	3½	3½	104	..	3 7 4
1974-94	3½	3½	101	..	3 4 6
London Elec.Trans. Ltd.	2½	2½	97	..	2 11 3
London & Home Counties1955-75	4½	4½	112	..	4 0 4
Lond.Pass.Trans.:					
A	4½	4½	123½	+3	3 13 0
B	5	5	121½	..	4 2 4
C	3	3½	66xd	+1½	4 18 6
WestMidlandsJ.E.A. 1948-68	5	5	109½	+½	4 11 4
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	117	..	5 2 5
Def.	1½	1½	28	..	5 7 2
Anglo-Portuguese	8	8	24/6	..	6 10 7
Cable & Wireless:					
5½ Pref.	5½	5½	114	+1	4 16 6
Ord.	4	4	80	+½	5 0 0
CanadianMarconi$1	Nil	4cts.	9/–	..	—
Globe Tel.& Tel.:					
Ord.	8½*	5*	37/6	+1/–	2 13 4
Pref.	6	6	30/–	..	4 0 0
Great NorthernTel. (£10)	Nil	Nil	20½	..	—
Inter. Tel. & Tel.	Nil	Nil	16	..	—
Marconi-Marine	7½	7½	33/–	..	4 11 0
Oriental Tel. Ord.	16	10	44/–	..	—
Telephone Props.	6	Nil	16/–	–1/–	—
Tele.Rentals(5/–)	10	10	11/6	..	4 7 0
Traction and Transport					
Anglo-Arg.Trans.:					
First Pref. (£5)	Nil	Nil	2/6	..	—
4% Inc.	Nil	Nil	8	..	—
Brit.Elec.Traction:					
Def. Ord.	45	45	1115	..	4 0 7
Pref. Ord.	8	8	175	..	4 11 5
Bristol Trams	10	10	52/6xd	+6d.	3 16 2
Brazil Traction	$1	$1⅛	26⅜	..	6 16 6
Calcutta Trams.	5½	6½	39/6	+1/–	3 5 10
Cape Elec. Trams	5	6	26/–	..	4 12 4
Lancs. Transport	10	10	44/3	..	4 10 4
Mexican Light:					
1st Bonds	5	5	100½	..	4 19 7
Rio 5% Bonds	5	5	106½	..	4 13 9
Southern Rly.:					
5% Prefd.	5	5	78xd	+1½	6 8 0
5% Pref.	5	5	118xd	..	4 4 9
T. Tilling	10	10	57/6xd	..	3 9 7
West Riding	10	10	44/6	..	4 10 0

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price Feb. 22	Rise or Fall	Yield p.c.
Equipment and Manufacturing					£ s. d.
Aron.Elec.Ord. ..	10	15	55/–	..	5 9 1
Assoc. Elec.:					
Ord.	10	10	52/–	+9d.	3 17 0
Pref.	8	8	39/6	+1/–	4 1 0
AutomaticTel.&Tel.	12½	12½	60/–	+9d.	4 3 4
Babcock & Wilcox	11	11	50/–	..	4 8 0
British Aluminium	10	10	48/–	..	4 3 4
British Insul. Ord.	20	20	5⅛	..	3 15 4
British Thermostat (5/–)	18½	18½	19/–	..	4 17 4
BritishVac.Cleaner (5/–)	15	30	27/6	..	5 9 1
Brush Ord.(5/–)..	6	8	8/6	..	4 14 2
Burco (5/–) ..	15	17½	15/6	..	5 13 0
Callender's ..	15	20	101/3	..	3 18 9
ChlorideElec.Storage	15	15	80/–	..	3 15 0
Cole, E. K. (5/–)	10	15	26/3	+3d.	2 17 2
Consolidated Signal	24	27½	6	..	4 11 8
Cossor, A. C. (5/–)	7½*	10*	24/3	+1/3	2 1 3
Crabtree (10/–) ..	17½	17½	38/3	..	4 11 5
Crompton Parkinson Ord. (5/–) ..	20	22½	28/–	..	4 0 4
E.M.I. (10/–) ..	6	8	28/6	+1/–	2 16 2
Elec.Construction	10	12½	50/6	..	4 19 0
EnfieldCableOrd.	12½	12½	59/–	..	4 4 8
English Electric .	10	10	50/6xd	+1/9	3 19 3
EnsignLamps(5/–)	25	15	20/–	..	3 15 0
Ericsson Tel. (5/–)	22*	20*	51/3	..	1 19 0
Ever Ready (5/–)	40	40	39/–	..	5 2 7
Falk Stadelmann	7½	7½	32/9	..	4 11 7
Ferranti Pref. ..	7	7	29/6	..	4 15 0
G.E.C.: Pref.	6½	6½	34/–	+1/–	3 16 6
Ord.	17½	17½	92/–	+9d.	3 16 1
Greenwood&Batley	15	15	41/3	..	7 5 9
HallTelephone(10/–)	12½	12½	26/–	+6d.	4 16 1
Henley's (5/–) ..	20	20	26/3	+9d.	3 16 2
4½% Pref. ..	4½	4½	23/–	..	3 18 3
Hopkinsons ..	15	17½	61/3	..	5 14 2
India Rubber Pref.	5½	5½	21/6	..	5 2 4
Intl. Combustion	30	30	6½	..	4 18 0
Johnson & Phillips	15	15	70/–	..	4 5 9
LancashireDynamo	20	22½	92/6	..	4 17 6
Laurence,Scott(5/–)	12½	12½	13/–	..	4 16 2
London Elec. Wire	7½	7½	34/6	..	4 7 0
Mather & Platt..	10	10	56/3	..	3 11 2
Metal Industries(B)	5	8	44/3	..	3 12 2
Met.Elec.CablePref.	5½	5½	21/3	..	5 3 6
Murex	20	20	102/–	+9d.	3 18 6
Pye Deferred (5/–)	25	25	26/3	..	4 15 3
Revo (10/–) ..	17½	17½	38/6	..	4 11 0
Reyrolle ..	12½	12½	68/9	..	3 12 8
Siemens Ord. ..	7½	7½	33/6	..	4 9 7
Strand Elec. (5/–)	7½	10	7/9	..	6 9 0
Switchgear& Cowans (5/–) ..	10	20	18/–	..	5 11 1
T.C.C. (10/–) ..	5	5	18/9	..	2 13 4
T.C. & M. ..	10	10	52/–	..	3 17 0
TelephoneMfg.(5/–)	9	9	11/–	..	4 1 10
Thorn Elec. (5/–)	20	20	22/6	..	4 9 0
Tube Investments	20	20	97/–	+1/–	4 2 4
Vactric (5/–) ..	Nil	Nil	13/3	+6d.	—
Veritys (5/–) ..	7½	7½	7/6	+3d.	5 0 0
Vickers (10/–) ..	10	10	19/–	+3d.	5 5 3
WalsallConduits(4/–)	55	55	44/6	..	4 18 9
Ward & Goldstone (5/–)	20	20	26/–	–1/–	3 17 0
WestinghouseBrake	12½	14	70/–	..	4 0 0
West, Allen (5/–)	7½	7½	6/9	..	5 11 2

* Dividends are paid free of Income Tax.

Stocks and Shares (*Continued from page* 281)

came into prominence at 12s. 3d. E. K. Cole at 26s. 3d. have gained the pence. Pye deferred keep at 26s. 3d. and are apparently overlooked. The yield on Pye deferred is 4¾ per cent.: that on E.M.I. shares is but £2 16s. 2d. although the dividend was recently put up from 6 per cent. to 8 per cent. E. K. Cole return about the same income as E.M.I. An excellent annual report from Radio Rentals has served to emphasise the optimism with which, amongst other things, the possibilities of television are regarded. The 5s. shares at 11s. 6d. give an income of £4 7s. per cent. on the 10 per cent. dividend which Radio Rentals is paying. The company is taking powers to increase its capital to £350,000, by creation of 400,000 new 5s. ordinary shares.

Preference Principles

An important question of principle has been revived by the proposal of a well-known iron, steel and coal company to wind up voluntarily, pay off its preference capital and offer, in exchange for the latter, either cash, at par, or ordinary shares. The proposal has led to lively criticism and to considerable opposition. It will be recalled that, sometime ago, holders of preference shares which carry a high rate of dividend were disturbed by the suggestion that a company could go into voluntary liquidation, with the express purpose of paying off its preference shares at their par value and of issuing other preference shares giving a lower rate of dividend.

Six per cent. Preference

There are plenty of companies with 6 per cent. preference issues, and it is felt that if voluntary liquidation is generally carried into effect, this will involve a very severe capital loss, seeing that the 6 per cent. preferences are mostly standing at substantial premiums. The previous apprehension blew over after a bit, but is revived by the proposals of the iron and steel company mentioned above. That the fears are unjustified would appear from the manner in which the prices of 6 per cent. preference shares are maintained. In the electricity supply group, many undertakings have issues of 6 per cent. preference shares, of £1 each, the prices of which stand at 30s. and over. Parliament may have something to say upon a matter which affects thousands of genuine investors.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2.

AUTOMATIC Telephone & Electric Co., Ltd., C. Gillings and C. E. Beale.—"Telephone or like systems." 10524. July 28th, 1942. (559016.)

M. C. Bloom.—"Electro-deposition of antimony." 10206/42. July 28th, 1941. (559164.)

British Thomson-Houston Co., Ltd.—"Magnetic gauges." 14212/42. October 11th, 1941. (559031.) "Electric control systems for electric valve apparatus arranged for interconnecting a supply and a load circuit." 8947/42. July 1st, 1941. (559081.) "Reversible control of capacitor electric motors." 8942/42. June 27th, 1941. (559113.) "Control devices for refrigerating apparatus." 8946/42. July 1st, 1941. (559114.) "Magnetic suspensions." 16322/42. November 19th, 1941. (559134.)

F. Callmann.—"Portable electric hand tool." 7660. June 5th, 1942. (559110.)

R. E. H. Carpenter.—"Electro-magnetic devices and especially electric telegraph relays." 5710. April 28th, 1942. (559047.)

H. Ellor and H. Read.—"Current collectors or shoes for trolley-pole heads of electrically driven vehicles." 15766. November 7th, 1942. (559129.)

Ericsson Telephones, Ltd., and S. H. D. Ward.—"Telephone or like contact plugs and their manufacture." Cognate applications 13393/42 and 1585/43. September 23rd, 1942. (559103.)

H. S. Molyneux-Ffennell, F. J. G. Van Den Bosch and Vacuum-Science Products, Ltd.—"Electron multiplier circuits." 10567. July 28th, 1942. (559021.)

A. Glynne.—"Apparatus for the stabilisation of alternating voltages." 14118. October 8th, 1942. (559105.)

Heenan & Froude, Ltd., and G. H. Walker.—"Means for combining eddy current clutches with electric motors." 4399. April 2nd, 1942. (559109.)

W. T. Henley's Telegraph Works Co., Ltd., and F. T. Griffiths.—"Extrusion machines." Cognate applications 10783/42, 14214/42 and 14215/42. July 31st, 1942. (559153.) Also 10784 and 10785. July 31st, 1942. (559154 and 559155.)

D. L. Hings.—"Radio amplifiers." 11792. August 21st, 1942. (559095.)

L. H. P. Jarrard and A. H. Jarrard (both legal representatives of W. J. Jarrard) and A. S. W. Payne.—"Terminal joints for electric cable with plastic sheath and jigs therefor." 10510. July 27th, 1942. (559014.)

T. S. Jones and Crompton Parkinson, Ltd.—"Electrical discharge tubes or lamps." 12735. September 9th, 1942. (559100.)

Kapella, Ltd., and R. E. Reason.—"Electrical chokes." 10548. July 28th, 1942. (559018.)

H. F. Liebrecht.—"Controlling electro-mechanical gears." 8601. June 23rd, 1942. (559056.)

J. Lucas, Ltd., and A. J. Bailey.—"Commutators for dynamo-electric machines." 10673. July 30th, 1942. (559059.)

Marconi's Wireless Telegraph Co., Ltd.—"Optical image projection systems." 10175/42. April 26th, 1941. (559065.) "Circuits for synchronising electric motors." 8860/42. June 28th, 1941. (559112.) "Electron beam discharge devices." 10703/42. January 31st, 1941. (559150.)

Marconi's Wireless Telegraph Co., Ltd. (Radio Corporation of America).—"Optical projection systems." 12119. August 28th, 1942. (559070.)

D. A. Muret and Metropolitan-Vickers Electric Co., Ltd.—"Flameproof electric switchgear." 10263. July 22nd, 1942. (559011.) "Flameproof enclosures for electrical or other apparatus." 20723/43. July 22nd, 1943. Divided out of 559011. (559040.)

P. Poillon, N. Sarruf and L. Castro.—"Electric underwater welding." 14937. October 23rd, 1942. (559033.)

Precision Developments Co., Ltd., and G. Olah.—"Synchronous remote controls." 5729. April 29th, 1942. (559148.)

A. W. Say, P. H. Morrison, P. J. Jarvis and Plessey Co., Ltd.,—"Electrical meters for measuring horse-power transmitted through a shaft." 9033. June 30th, 1942. (559116.)

Siemens Bros. & Co., Ltd., and G. H. Foot.—"Electric signalling systems." 10773. July 31st, 1942. (559121.)

Siemens Electric Lamps & Supplies, Ltd., and J. N. Aldington.—"Metal vapour electric-discharge lamps." 11531. August 17th, 1942. (559093.)

Standard Telephones & Cables, Ltd.—"Demountable electron-discharge tube." 10734/42. August 7th, 1941. (559057.) "Electron-discharge devices for electric signal transmission systems." 10728/42. May 22nd, 1941. (559151.) "Frequency detector." 10368/42. May 29th, 1941. (559161.)

Standard Telephones & Cables, Ltd., and J. L. Ashford.—"Electric switches of the mercury type." 10526. July 28th, 1942. (559017.)

Standard Telephones & Cables, Ltd., J. L. Ashford and W. A. Billings.—"Electric resistance welding equipment." 10732. July 31st, 1942. (559152.)

Standard Telephones & Cables, Ltd., C. W. Earp and J. D. Weston.—"Indicating systems for electrical signals." 10544. July 28th, 1942. (559062.)

Tecalemit, Ltd., and C. C. S. Le Clair.—"Heaters for aircraft." 10796. July 31st, 1942. (559087.)

Telefonaktiebolaget L. M. Ericsson.—"Periodic switching apparatus for the automatic control of temperature or other variable quantity." 14424/42. October 21st, 1941. (559126.)

Telephone Manufacturing Co., Ltd., and L. H. Paddle.—"Reduction of metals to powdered or granular form." 5828. April 30th, 1942. (559049.)

W. W. Triggs. (Specialities Development Corporation).—"Liquid-contact electric circuit actuators operated by immersion." 5766. April 29th, 1942. (559077.)

E. L. C. White.—"Electron-discharge valve amplifying circuits." 6524. May 13th, 1942. (559078.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Belfast.—March 7th. Electricity Department. Stores. (February 11th.)

Londonderry.—March 7th. Town Council. House service cut-outs, joint box compound, meters, electrical accessories, lubricating oils, transformers and kiosks, cables, and cable covering tiles. Specifications from the Electricity Department, Strand Road, Londonderry.

Manchester.—March 3rd. Electricity Department. 33- and 6·6-kV switchgear at generating stations and substations. (February 11th.)

Wilton.—March 1st. Town Council. Electric motor and close-coupled centrifugal pump (9,000 gal. per hr. against a maximum head of 196 ft.). Specifications from the town clerk.

Wortley.—March 31st. Rural District Council. Electrically driven borehole pumping unit. J. Morton, Council Offices, Grenoside, nr. Sheffield.

Orders Placed

Bedford.—Highways Committee. Recommended. Twenty-four tubular steel lamp standards with dual purpose lanterns for post-war lighting and which can be used for star lighting (£20 15s. each).—Revo Electric Co.

Cardiff.—Electricity Committee. Accepted. Battery plates (£250).—Tudor Accumulator Co.

London.—FULHAM.—Electricity Committee. Recommended. Additional overspeed prevention equipment for turbines (£1,600).—Metropolitan-Vickers.

LEWISHAM.—Welfare Committee. Accepted. Installation of electric lighting, heating and power at Ladywell nursery (£159).—J. H. Plant.

METROPOLITAN WATER BOARD. Accepted. Electrically driven borehole pump and electrically driven centrifugal pump at Streatham works (£1,367).—Pulsometer Engineering Co.; three automatic electrically driven re-pumping sets for Waltham Abbey works (£1,465).—Harland Engineering Co.

Oldham.—Electricity Committee. Accepted. Installation of "Mulsifyre" fire protection system at power station.—Mather & Platt.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberffraw (Anglesey).—Public Hall for Building Committee; J. O. Williams, hon. secretary.

Airdrie.—Hospital extensions, Wester Moffat; burgh surveyor, Royal Buildings, Graham Street.

Amble (Northumberland).—Licence granted for a cinema to accommodate 700; P. L. Browne, Son & Harding, Pearl Buildings, Newcastle-on-Tyne.

Ashton-under-Lyne.—Central school kitchen, Fleet Street and Church Street; A. T. Kemp, borough surveyor, Municipal Buildings.

Burton-on-Trent.—Extensions, Technical institute; borough engineer.

Bury.—Messroom and boiler house at works, Lower Woodhill Road; Joseph Webb & Sons, Irwell Forge.

Carmel (Caernarvon).—Village Hall for Building Committee; secretary.

Castleton (near Rochdale).—Works canteen; Whipp & Bourne, Ltd., Yates' Mill, Victoria Street.

Clayton.—Works additions; J. Riley & Sons, builders, 59, Forge Lane, Bradford, Manchester, 11.

Dorset.—Canteen, Colliton Street, School, Dorchester; county architect, Dorchester.

Dukinfield.—Houses (34), Victoria Farm site; E. N. Stannion, borough surveyor.

Eccles.—Works additions; Carlisle Electrical Manufacturing Co., Ltd., Salter Lane.

Glasgow.—Central kitchens at six schools for Corporation; master of works.

Works alterations and additions, Bulldale Road, Yoker; Bull's Metal & Melloid Co., Ltd.

Gravesend.—Additions, Gravesend and North Kent Hospital (£4,732); governors.

Huddersfield. — Additional kitchens at Paddock and Woodhouse Hall (£10,500); W. Jagger, borough engineer, Municipal Offices, Peel Street.

Kent.—Additions, County School for Boys, Gravesend; laboratory and electrical work, Technical College, Erith; huts at School of Art, Bromley; extensions, Poverest and Crofton Schools, Orpington (£10,000); and school at Bexley to be built by new methods of construction (£7,000); county architect, Maidstone.

Lancashire.—Alterations (including electrical work and equipment) at 14 Institutions for Public Assistance Committee (£17,000).—L. Evans, county architect, County Buildings, Fishergate Hill, Preston.

School kitchen, Leyland; county architect.

Llanfyllin.—Farm workers' houses, Ardleen, Llanerfyl, Meifod and Llansantffraid (£7,444), and central canteen kitchen and dining room (£2,200); Dean & Co., builders, Penybryn, Llanfyllin, Montgomeryshire.

London.—1,790 tenements, Woodberry Down, Stoke Newington (£1,191,000); L.C.C. architect.

Emergency water schemes for Metropolitan Water Board (£17,250); Binnie, Deacon & Gourley.

Lewisham.—Nursery, Ladywell Park (£3,611); Henry Kent (Builders), Ltd.

Manchester.—Garage and workshop, Derby Street and Stocks Street; G. Dobson & Sons, builders, 42, Tonman Street, Manchester, 3.

Northenden.—Works extensions; G. Grenfield Baines, architect, 12-24, Guildhall Street, Preston.

Northumberland.—Rescue depots and a garage, Gosforth (£900); county architect, County Hall, Newcastle-on-Tyne.

Oxford.—Rebuilding eye hospital; Oxford and District Joint Hospitals Board, 16, King Edward Street.

Salford.—Works extensions, Wellington Street; John Shaw & Sons (Salford), Ltd.

Sedgley.—Messroom, Deepdale Lane; A. Allen & Son.

Southall.—Nursery, Sports Ground (£2,143); Taylor Woodrow Construction, Ltd.

Stockport.—Additions to school, Broadstone Road, Reddish, for junior department; L. Yates, Education architect, Education Offices, Town Hall.

Additions, Hempshaw Lane Dye Works; Oswald Hazeldine, Ltd., Hempshaw Lane.

Stockport.—Workshops (£10,000), for Board of Management; secretary, Institute for the Blind, St. Peter's Gate.

Stockton-on-Tees.—Workshop and offices, Church Road; George Hope, builder.

Stoke-on-Trent.—Extensions to maternity hospital, Harthill; A. Burton, city engineer, Town Hall.

Stourbridge.—Church hall for St. John's Parochial Church Council (£5,000); Rev. E. A. Lloyd, St. John's Vicarage.

Stranraer.—Engineering workshop, showrooms and stores for George Henderson, Ltd., Kelso; Mr. Goudie, architect.

Timperley.—Works canteen, Attenbury's Lane, Park Road, for W. Francis & Co., Ltd.; Matthews & Searle, Ltd., builders, Chepstow Road, Chorlton-cum-Hardy, Manchester.

Warwickshire.—Extensions, King Edward School, Nuneaton (£4,250); maternity home, Tiddington (£2,270); and hutment school, Lode Lane, Solihull; county architect, Warwick.

West Hartlepool.—Workshop, Andrew Street; Heslop & Hall, Ltd., plumbers, West Hartlepool.

Sculleries at Lynnfield and Oxford Street Schools, and conversion of Maycrete huts at Park Square, Jesmond Road, Elwick Road and Hart Lane, into dining halls; borough engineer.

Widdrington.—Completion of 10 blocks of new R.D.C. houses; T. T. Watson, surveyor, R.D.C. Offices, Morpeth.

Worcestershire.—Kitchen and scullery, Stourbridge Road, Bromsgrove; H. Rowe & Son, county architects, 38, Foregate Street, Worcester.

Whitaker's Almanack

INFORMATION on a large variety of subjects is contained in the 1944 edition of "Whitaker's Almanack," which is published by J. Whitaker & Sons, Ltd. The contents range from details of astronomy to the geographical features of Zanzibar, and a very useful section, entitled the "Diary of the War," records the achievements of the forces of the Allied Nations. Various statistical tables of post-war reconstructional interest have been added to this edition. The Almanack, which is published in three editions, the library edition, with coloured maps, price 21s. net, the complete edition, 10s. net and the abridged edition, 6s. net, is obtainable from the publishers at 13, Bedford Square, London, W.C.1.

Forthcoming Events

Institution of Electrical Engineers.—Thursday, March 2nd, 5.30 p.m. "Internal Discharges in Dielectrics, their Observation and Analysis," by Dr. A. E. W. Austen and Miss W. Hackett, Ph.D.

Wireless Section.—Wednesday, March 1st, 5.30 p.m. "Some Applications of Thyratrons in Radio Engineering," by Mr. A. J. Maddock, M.Sc.

Transmission Section.—Wednesday, March 8th, 5.30 p.m. "Reinforced Concrete Transmission Line Supports," by Messrs. E. C. Neate and W. F. Bowling.

Installations Section.—Thursday, March 9th, 5.30 p.m. "The Influence of Maintenance Requirements on the Design of Electrical Installation Equipment," by Mr. Hamlyn Drake, M.A.

North-Eastern Centre.—Monday, February 28th, 6.15 p.m. Neville Hall, Newcastle-on-Tyne. "Effect of the National Grid on the Operation and Maintenance of Secondary Power Stations," by Mr. R. A. W. Connor.

South Midland Wireless Group.—Monday, February 28th, 6 p.m. James Watt Institute, Birmingham. "Wave Guides in Electrical Communications," by Mr. J. Kemp.

London Students' Section.—Monday, February 28th, 7 p.m. "Power Station Auxiliaries," by Mr. G. T. Shaw.

South Midland Students' Section.—Tuesday, February 29th, 6.30 p.m. James Watt Insitute, Birmingham. "Mercury Arc Rectifiers," by Mr. H. B. Calverley, B.Sc.

Bristol Students' Section.—Friday, March 3rd, 7.15 p.m. Pump Room, Bath. "An I.E.E. Student Sees the United States of America," by Mr. R. W. Adams.

Electrodepositors' Technical Society.—*London.*—Monday, February 28th, Northampton Polytechnic, E.C.1. "Electrodeposition of Brass," by Dr. J. Kronsbein.

Institute of Welding.—Wednesday, March 1st, 5.30 p.m. Institution of Civil Engineers, S.W.1. "Recent Developments in Welding Light Metals," by Mr. W. K. B. Marshall, B.Eng.

Engineer Surveyors' Association.—*Newcastle.*—Friday, March 3rd, 7 p.m. County Hotel. "Principles and Operation of Radio-Telephony," by Mr. F. M. Inglas.

Glasgow.—Friday, March 3rd, 8 p.m. Institute of Engineers and Shipbuilders. "Engineering Naval Experiences," by Mr. D. H. M. Bee.

Royal Society of Arts.—Monday, March 6th, 1.45 p.m. John Adam Street, Adelphi, London, W.C.2. Cantor Lecture on "Hydro-electricity," by Sir William Halcrow.

Illuminating Engineering Society.—*Bath and Bristol Centre.*—Monday, March 6th, 7 p.m. Grand Hotel, Broad Street, Bristol. Presidential address by Dr. H. Buckley.

Association of Mining Electrical and Mechanical Engineers.—*West of Scotland Branch.*—Saturday, March 11th. Film display, "On-Load Tap Change Devices" and "Oil Fire Fighting."

South Wales Branch.—Thursday, March 16th. Pontypridd. Visit of Mr. G. M. Harvey, Chief Electrical Inspector of Mines, and discussion on his annual report.

North-Western Branch.—Monday, March 27th, 7 p.m. Wigan and District Mining and Technical College. Lecture on "Underground Fires," by Mr. A. J. G. Coulshed.